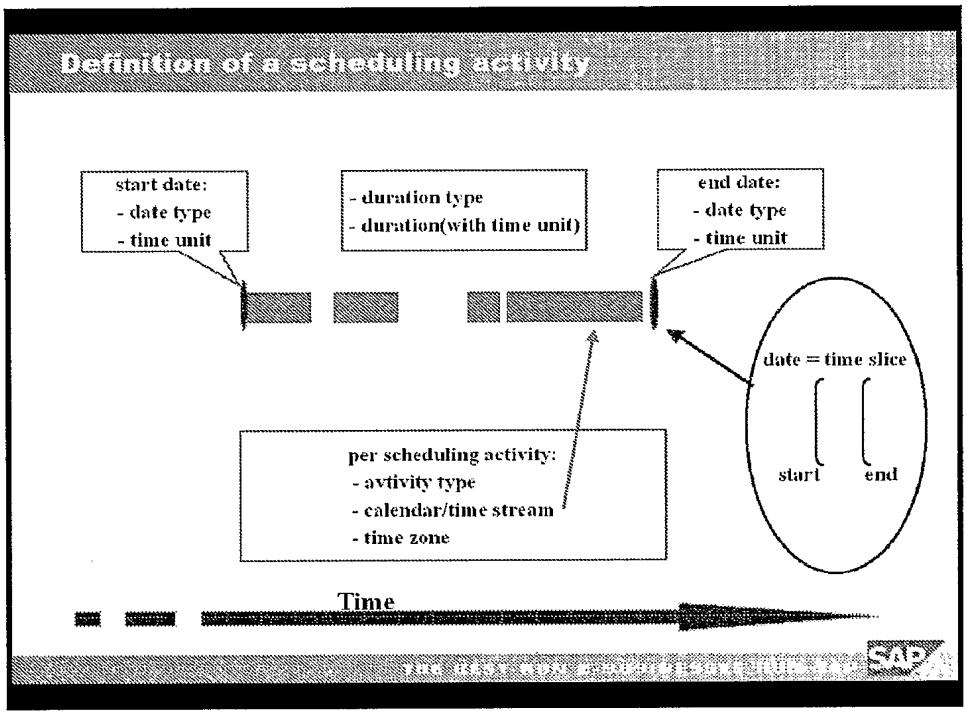
Definition of a scheduling activity
start date:
- date type
- time unit
- duration type
- duration(with time unit)
end date:
- date type
- time unit
date = time slice
start
end
per scheduling activity:
- avtivity type
- calendar/time stream
- time zone
Time

Fig. 1A

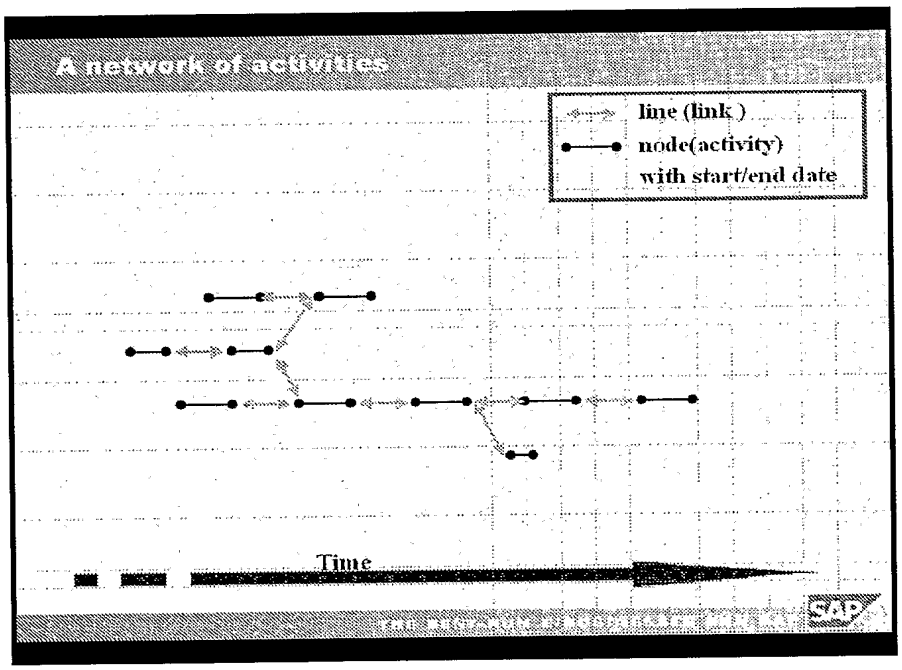
A network of activities
line (link)
node(activity)
with start/end date
Time

Fig. 1B

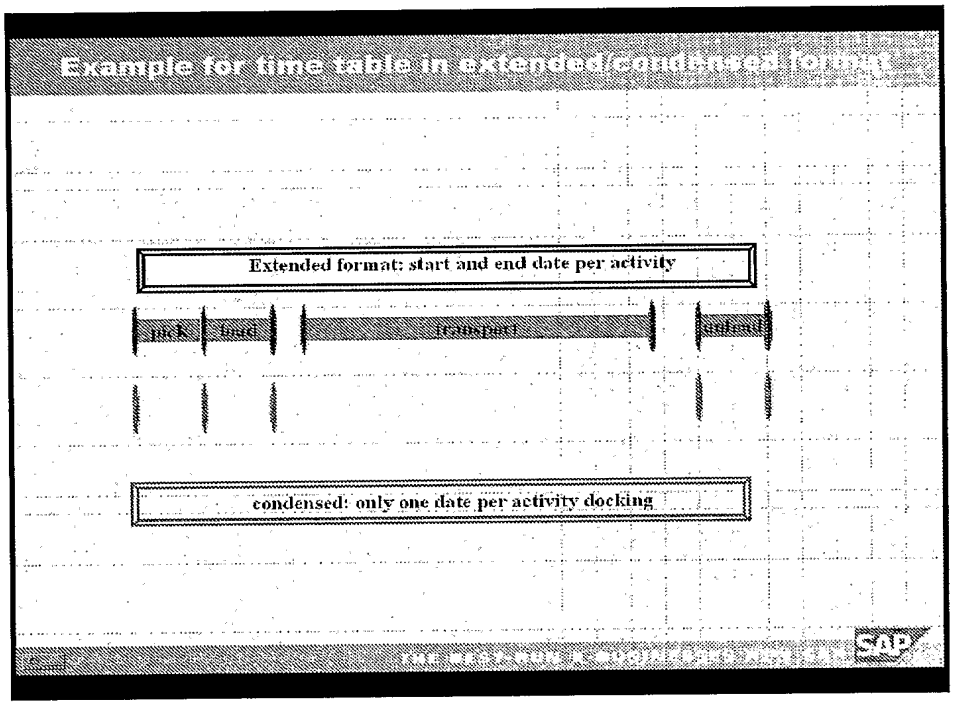
Example for time table in extended/condensed format
Extended format: start and end date per activity
pick
load
transport
unload
condensed: only one date per activity docking
SAP

Fig. 1C

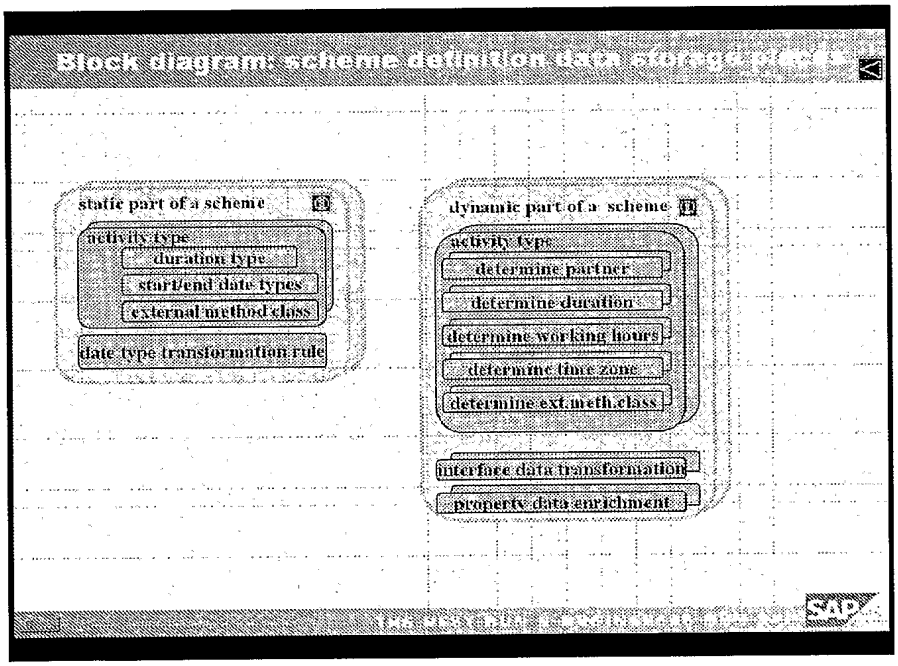
static part of a scheme
activity type
duration type
start/end date types
external method class
date type transformation rule
dynamic part of a scheme
activity type
determine partner
determine duration
determine working hours
determine time zone
determine ext.meth.class
interface data transformation
property data enrichment

Fig. 2

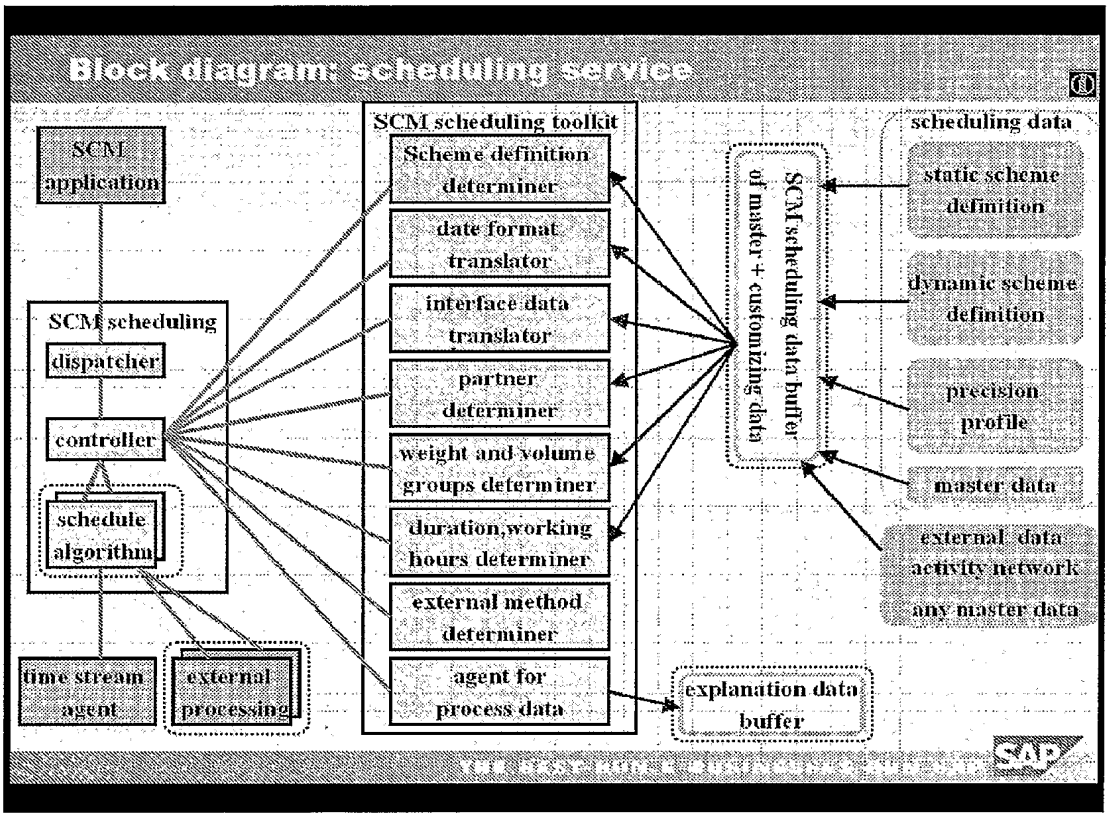
Block diagram: scheduling service
SCM application
SCM scheduling
dispatcher
controller
schedule algorithm
time stream agent
external processing
SCM scheduling toolkit
Scheme definition determiner
date format translator
interface data translator
partner determiner
weight and volume groups determiner
duration,working hours determiner
external method determiner
agent for process data
SCM scheduling data buffer of master + customizing data
explanation data buffer
scheduling data
static scheme definition
dynamic scheme definition
precision profile
master data
external data
activity network
any master data

Fig. 3

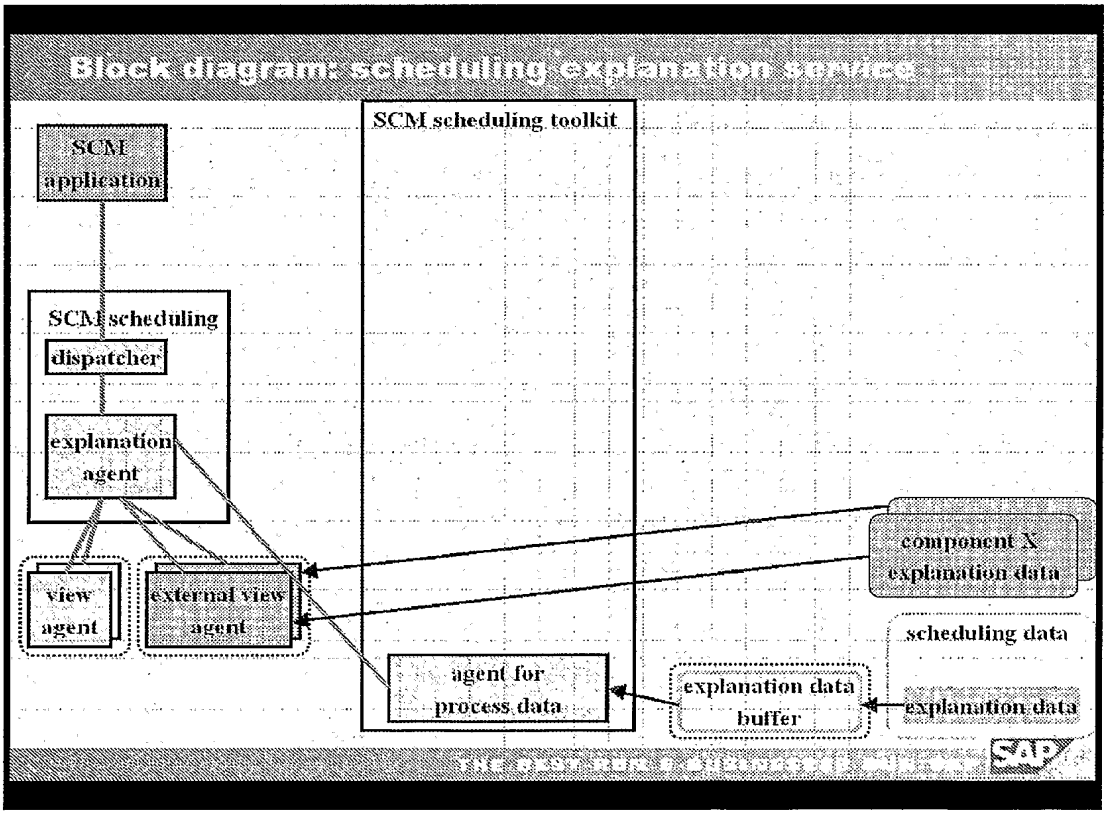
Block diagram: scheduling explanation service
SCM scheduling toolkit
SCM application
SCM scheduling dispatcher
explanation agent
view agent
external view agent
component X explanation data
scheduling data
agent for process data
explanation data buffer
explanation data

Fig. 4

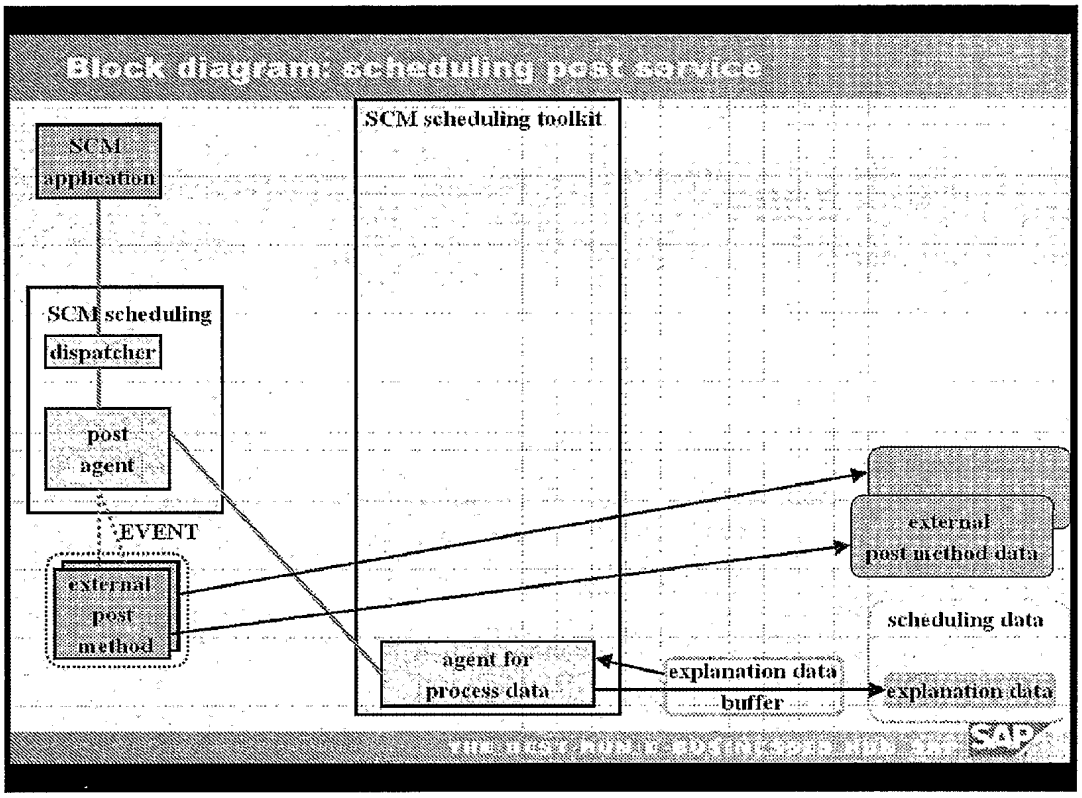
Block diagram: scheduling post service
SCM application
SCM scheduling toolkit
SCM scheduling dispatcher
post agent
EVENT
external post method
external post method data
scheduling data
agent for process data
explanation data buffer
explanation data

Fig. 5

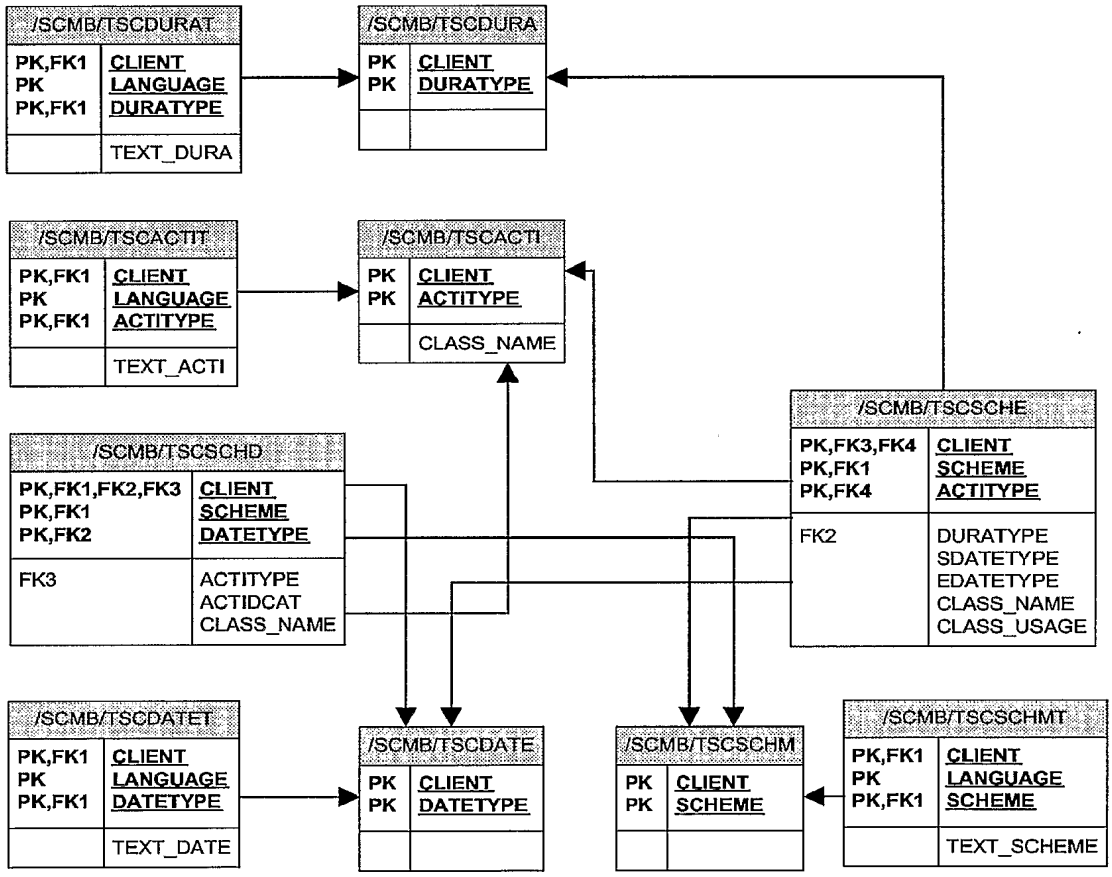
/SCMB/TSCDURAT
PK,FK1 CLIENT
PK LANGUAGE
PK,FK1 DURATYPE
TEXT_DURA
/SCMB/TSCDURA
PK CLIENT
PK DURATYPE
/SCMB/TSCACTIT
PK,FK1 CLIENT
PK LANGUAGE
PK,FK1 ACTITYPE
TEXT_ACTI
/SCMB/TSCACTI
PK CLIENT
PK ACTITYPE
CLASS_NAME
/SCMB/TSCSCHE
PK,FK3,FK4 CLIENT
PK,FK1 SCHEME
PK,FK4 ACTITYPE
FK2
DURATYPE
SDATETYPE
EDATETYPE
CLASS_NAME
CLASS_USAGE
/SCMB/TSCSCHD
PK,FK1,FK2,FK3 CLIENT
PK,FK1 SCHEME
PK,FK2 DATETYPE
FK3
ACTITYPE
ACTIDCAT
CLASS_NAME
/SCMB/TSCDATET
PK,FK1 CLIENT
PK LANGUAGE
PK,FK1 DATETYPE
TEXT_DATE
/SCMB/TSCDATE
PK CLIENT
PK DATETYPE
/SCMB/TSCSCHM
PK CLIENT
PK SCHEME
/SCMB/TSCSCHMT
PK,FK1 CLIENT
PK LANGUAGE
PK,FK1 SCHEME
TEXT_SCHEME

Fig. 6A

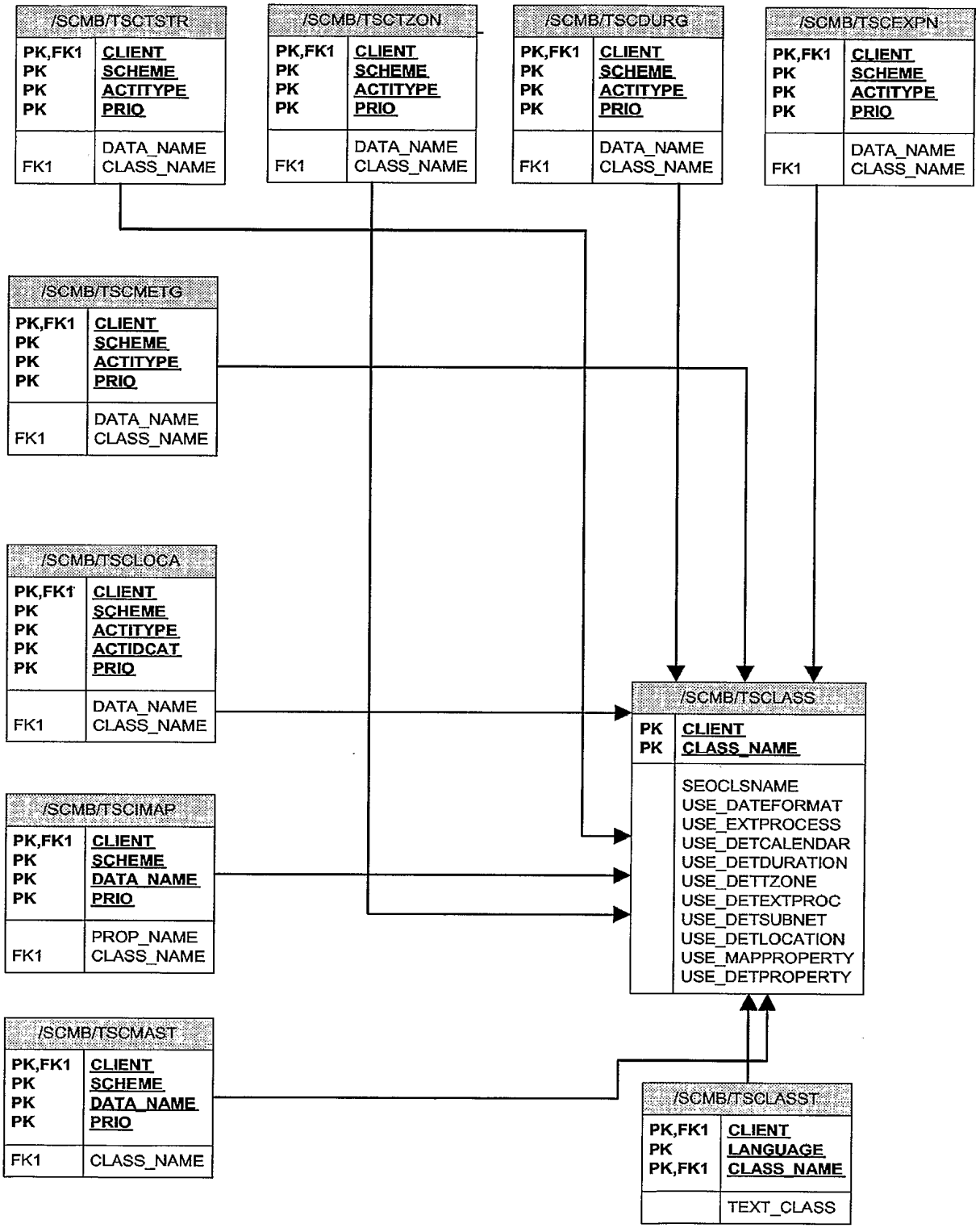
/SCMB/TSCTSTR
PK,FK1 CLIENT
PK SCHEME
PK ACTITYPE
PK PRIO
DATA_NAME
FK1 CLASS_NAME
/SCMB/TSCTZON
PK,FK1 CLIENT
PK SCHEME
PK ACTITYPE
PK PRIO
DATA_NAME
FK1 CLASS_NAME
/SCMB/TSCDURG
PK,FK1 CLIENT
PK SCHEME
PK ACTITYPE
PK PRIO
DATA_NAME
FK1 CLASS_NAME
/SCMB/TSCEXPN
PK,FK1 CLIENT
PK SCHEME
PK ACTITYPE
PK PRIO
DATA_NAME
FK1 CLASS_NAME
/SCMB/TSCMETG
PK,FK1 CLIENT
PK SCHEME
PK ACTITYPE
PK PRIO
DATA_NAME
FK1 CLASS_NAME
/SCMB/TSCLOCA
PK,FK1 CLIENT
PK SCHEME
PK ACTITYPE
PK ACTIDCAT
PK PRIO
DATA_NAME
FK1 CLASS_NAME
/SCMB/TSCLASS
PK CLIENT
PK CLASS_NAME
SEOCLSNAME
USE_DATEFORMAT
USE_EXTPROCESS
USE_DETCALENDAR
USE_DETDURATION
USE_DETTZONE
USE_DETEXTPROC
USE_DETSUBNET
USE_DETLOCATION
USE_MAPPROPERTY
USE_DETPROPERTY
/SCMB/TSCIMAP
PK,FK1 CLIENT
PK SCHEME
PK DATA_NAME
PK PRIO
PROP_NAME
FK1 CLASS_NAME
/SCMB/TSCMAST
PK,FK1 CLIENT
PK SCHEME
PK DATA_NAME
PK PRIO
FK1 CLASS_NAME
/SCMB/TSCLASST
PK,FK1 CLIENT
PK LANGUAGE
PK,FK1 CLASS_NAME
TEXT_CLASS

Fig. 6B

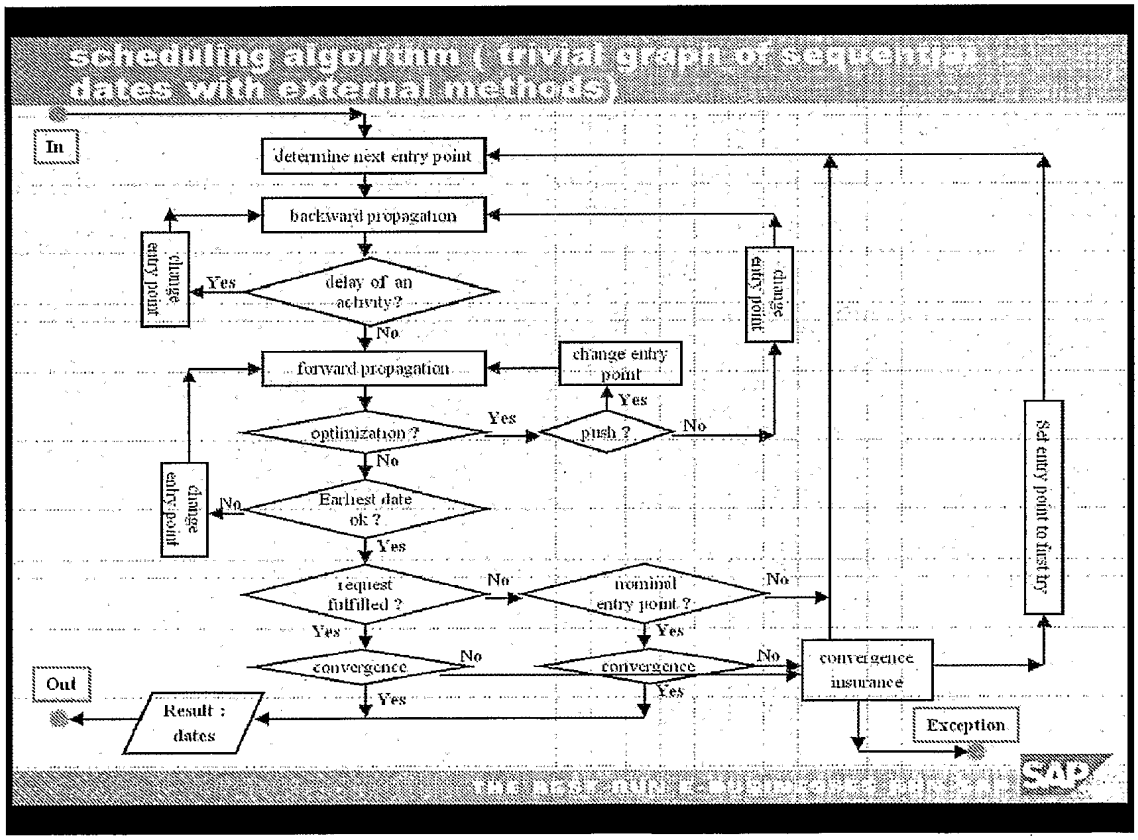
scheduling algorithm (trivial graph of sequential dates with external methods)
In
determine next entry point
backward propagation
change entry point
Yes
delay of an activity?
No
forward propagation
change entry point
change entry point
Yes
optimization ?
Yes
push ?
No
No
change entry point
No
Earliest date ok ?
Yes
request fulfilled ?
No
nominal entry point ?
No
Yes
Yes
convergence
No
convergence
No
convergence insurance
Set entry point to first try
Out
Yes
Yes
Result : dates
Exception

Fig. 7A

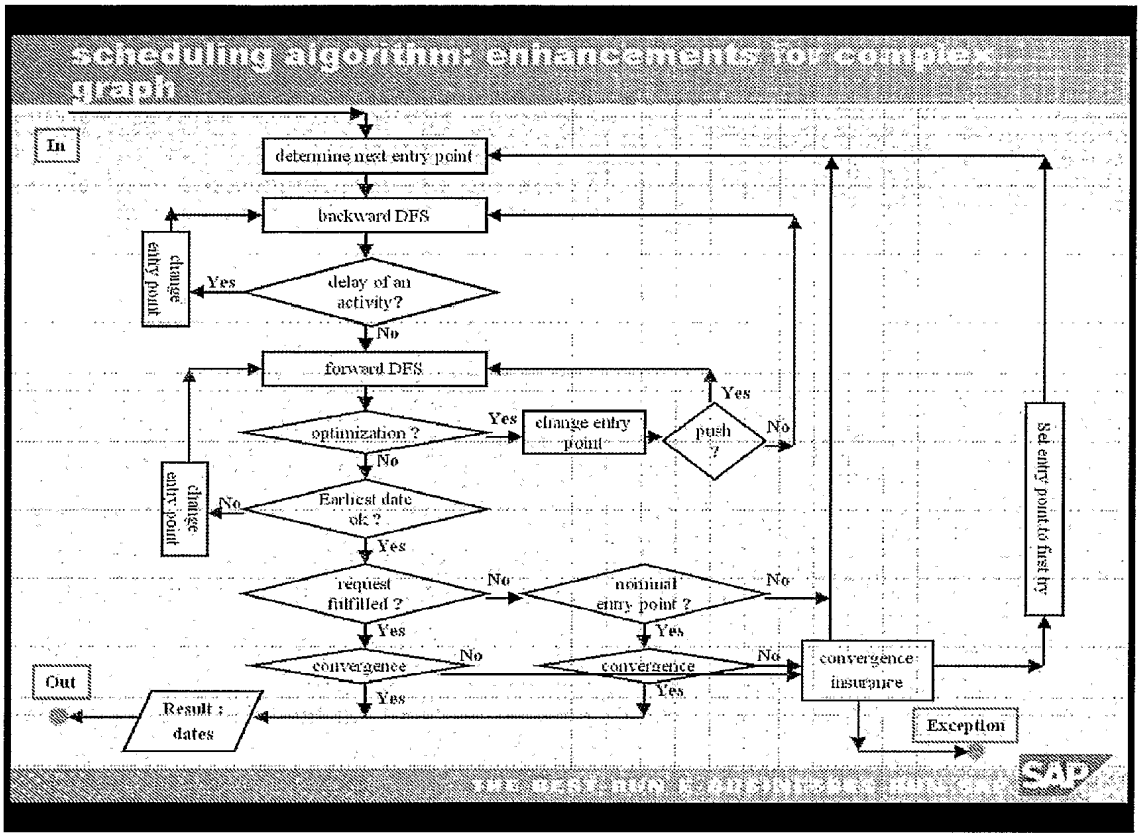
scheduling algorithm: enhancements for complex graph
In
determine next entry point
backward DFS
change entry point
Yes
delay of an activity?
No
forward DFS
optimization ?
Yes
change entry point
push ?
Yes
No
change entry point
No
Earliest date ok ?
Yes
request fulfilled ?
No
nominal entry point ?
No
Yes
Yes
convergence
No
convergence
No
convergence insurance
Yes
Yes
Out
Result : dates
Exception
Set entry point to first try

Fig. 7B

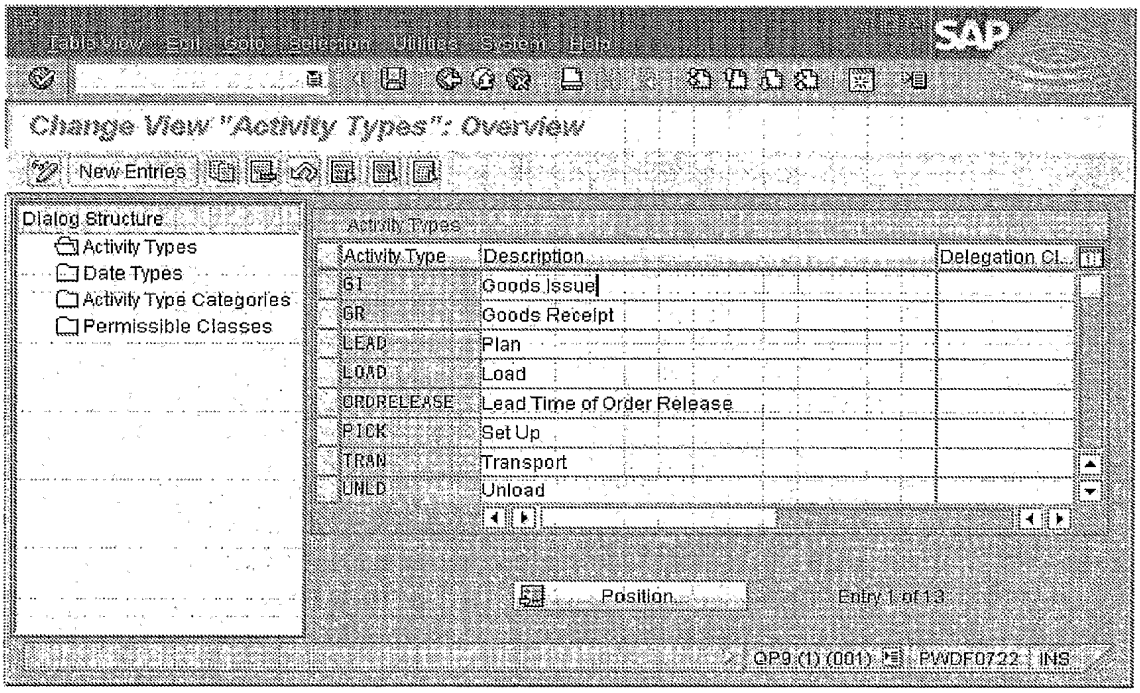
Change View "Activity Types": Overview
New Entries
Dialog Structure
Activity Types
Date Types
Activity Type Categories
Permissible Classes
Activity Types
Activity Type
Description
Delegation Cl...
GI
Goods Issue
GR
Goods Receipt
LEAD
Plan
LOAD
Load
ORDRELEASE
Lead Time of Order Release
PICK
Set Up
TRAN
Transport
UNLD
Unload
Position
Entry 1 of 13
QP9 (1) (001)
PWDF0722
INS

Fig. 8A

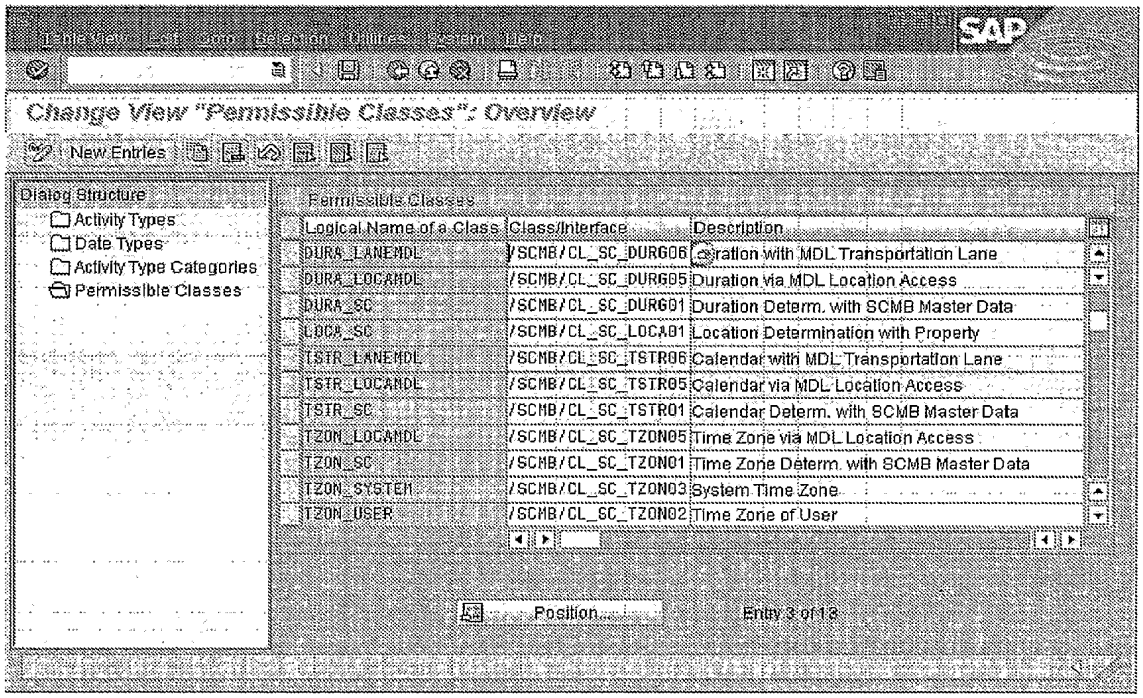
Change View "Permissible Classes": Overview
New Entries
Dialog Structure
Activity Types
Date Types
Activity Type Categories
Permissible Classes
Permissible Classes
Logical Name of a Class
Class/Interface
Description
DURA_LANEMDL
/SCMB/CL_SC_DURG06
Duration with MDL Transportation Lane
DURA_LOCAMDL
/SCMB/CL_SC_DURG05
Duration via MDL Location Access
DURA_SC
/SCMB/CL_SC_DURG01
Duration Determ. with SCMB Master Data
LOCA_SC
/SCMB/CL_SC_LOCA01
Location Determination with Property
TSTR_LANEMDL
/SCMB/CL_SC_TSTR06
Calendar with MDL Transportation Lane
TSTR_LOCAMDL
/SCMB/CL_SC_TSTR05
Calendar via MDL Location Access
TSTR_SC
/SCMB/CL_SC_TSTR01
Calendar Determ. with SCMB Master Data
TZON_LOCAMDL
/SCMB/CL_SC_TZON05
Time Zone via MDL Location Access
TZON_SC
/SCMB/CL_SC_TZON01
Time Zone Determ. with SCMB Master Data
TZON_SYSTEM
/SCMB/CL_SC_TZON03
System Time Zone
TZON_USER
/SCMB/CL_SC_TZON02
Time Zone of User
Position...
Entry 3 of 13

Fig. 8B

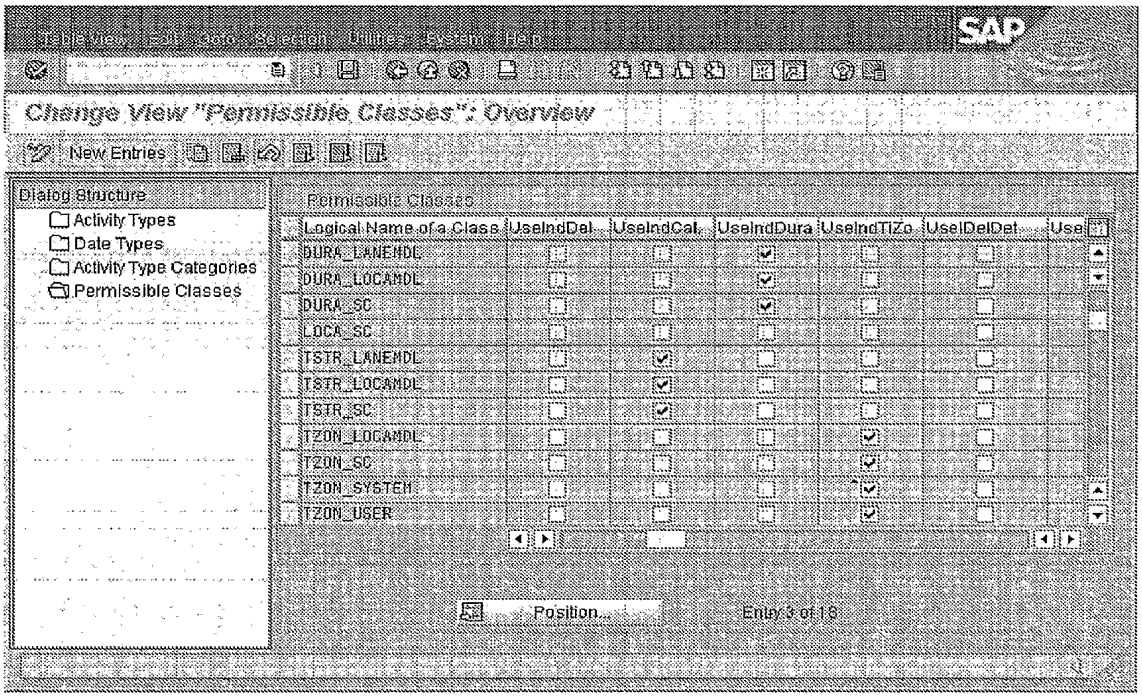
Change View "Permissible Classes": Overview
New Entries
Dialog Structure
Activity Types
Date Types
Activity Type Categories
Permissible Classes
Permissible Classes
Logical Name of a Class
UseIndDel
UseIndCal
UseIndDura
UseIndTiZo
UseIDelDet
DURA_LANEMDL
DURA_LOCAMDL
DURA_SC
LOCA_SC
TSTR_LANEMDL
TSTR_LOCAMDL
TSTR_SC
TZON_LOCAMDL
TZON_SC
TZON_SYSTEM
TZON_USER
Position...
Entry 3 of 18

Fig. 8C

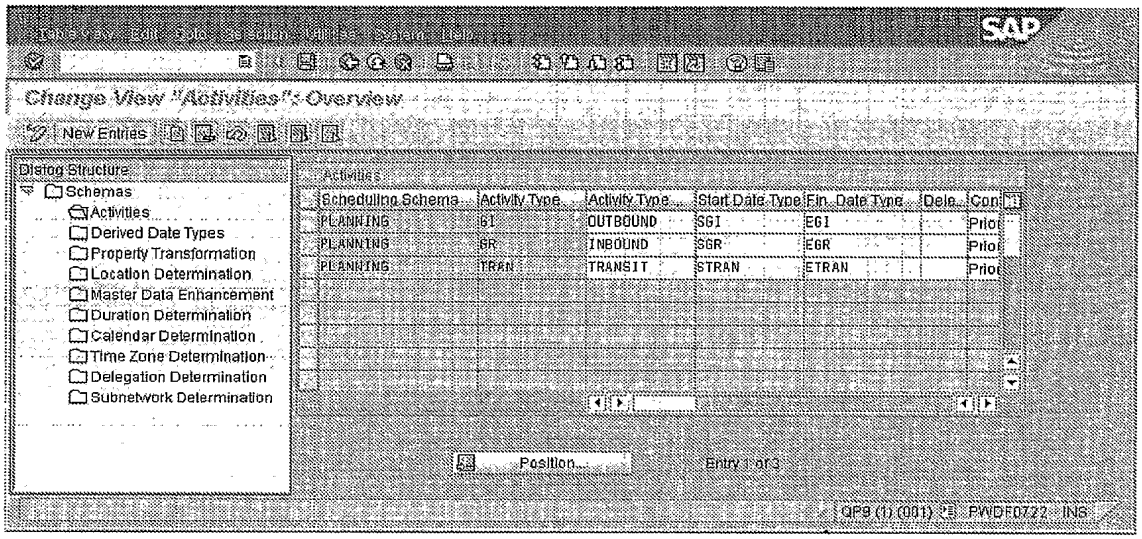
Change View "Activities": Overview
New Entries
Dialog Structure
Schemas
Activities
Derived Date Types
Property Transformation
Location Determination
Master Data Enhancement
Duration Determination
Calendar Determination
Time Zone Determination
Delegation Determination
Subnetwork Determination
Activities
Scheduling Schema
Activity Type
Activity Type
Start Date Type
Fin. Date Type
Dele...
Con
PLANNING GI OUTBOUND SGI EGI Prio
PLANNING GR INBOUND SGR EGR Prio
PLANNING TRAN TRANSIT STRAN ETRAN Prio
Position...
Entry 1 of 3
QP9 (1) (001) PWDF0722 INS

Fig. 8D

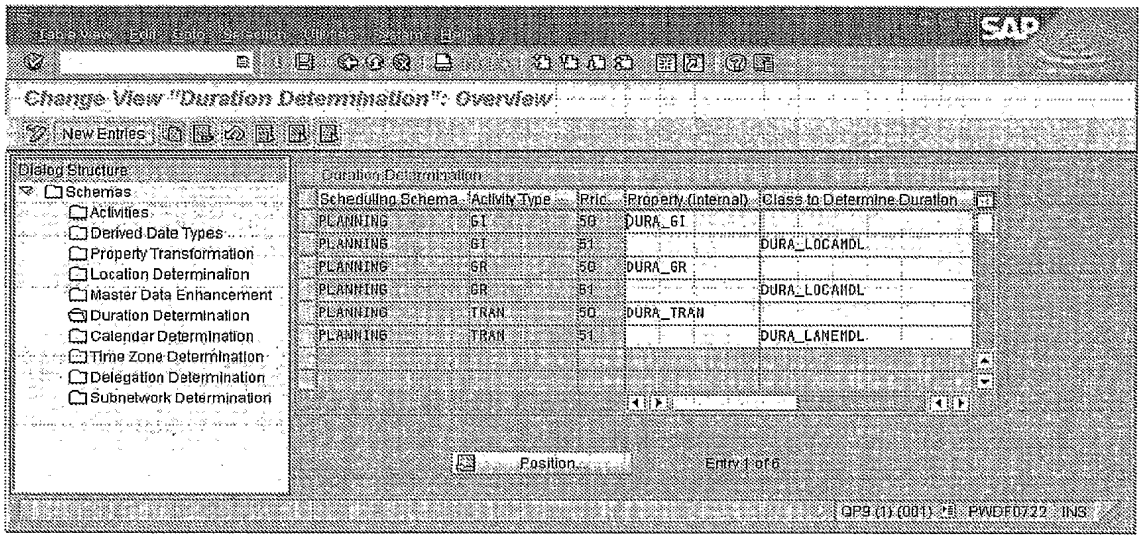
Change View "Duration Determination": Overview
New Entries
Dialog Structure
Schemas
Activities
Derived Date Types
Property Transformation
Location Determination
Master Data Enhancement
Duration Determination
Calendar Determination
Time Zone Determination
Delegation Determination
Subnetwork Determination
Duration Determination
Scheduling Schema
Activity Type
Prio
Property (Internal)
Class to Determine Duration
PLANNING GI 50 DURA_GI
PLANNING GI 51 DURA_LOCAMDL
PLANNING GR 50 DURA_GR
PLANNING GR 51 DURA_LOCAMDL
PLANNING TRAN 50 DURA_TRAN
PLANNING TRAN 51 DURA_LANEMDL
Position...
Entry 1 of 6
QP9 (1) (001)
PWDF0722
INS

Fig. 8E

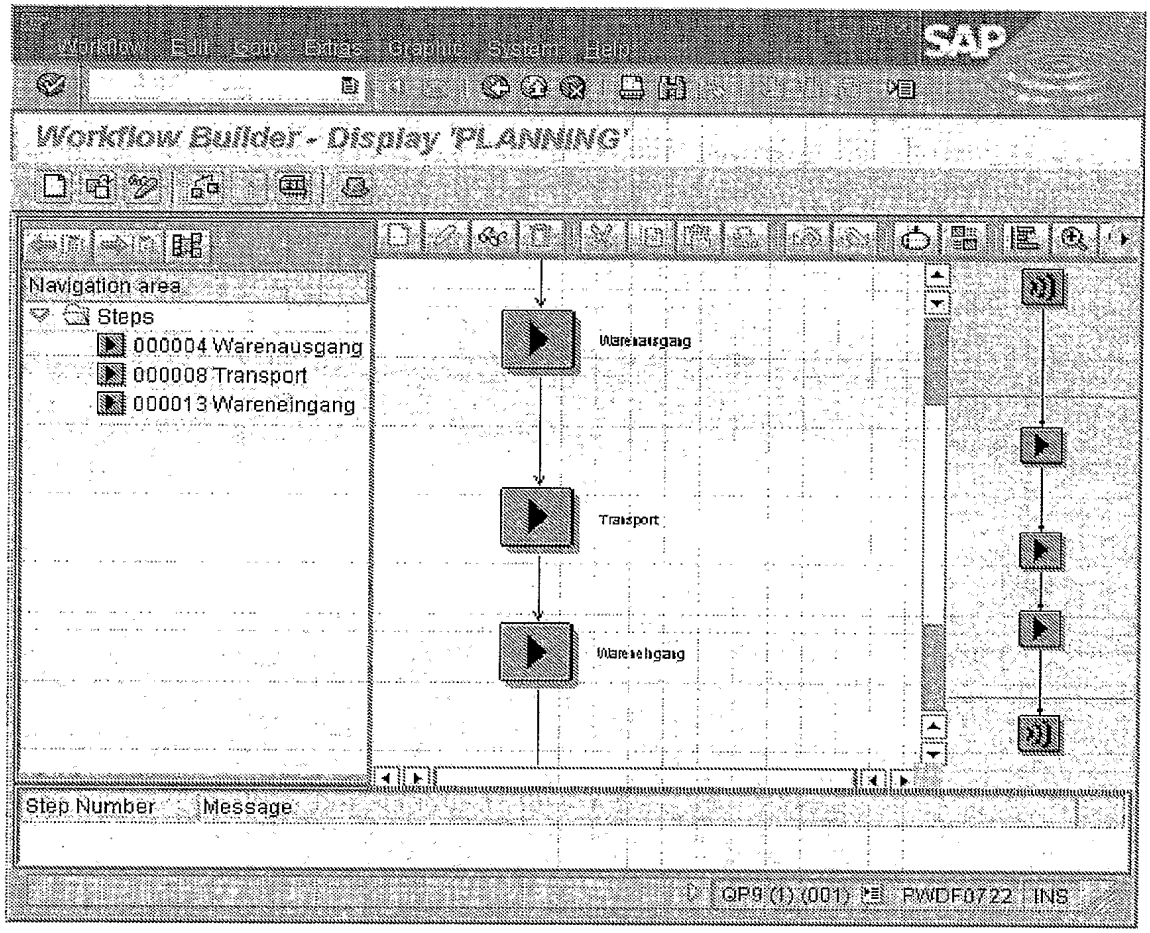
Workflow Edit Goto Extras Graphic System Help
SAP
Workflow Builder - Display 'PLANNING'
Navigation area
Steps
000004 Warenausgang
000008 Transport
000013 Wareneingang
Warenausgang
Transport
Wareneingang
Step Number
Message
OP9 (1) (001)
PWDF0722
INS

Fig. 9

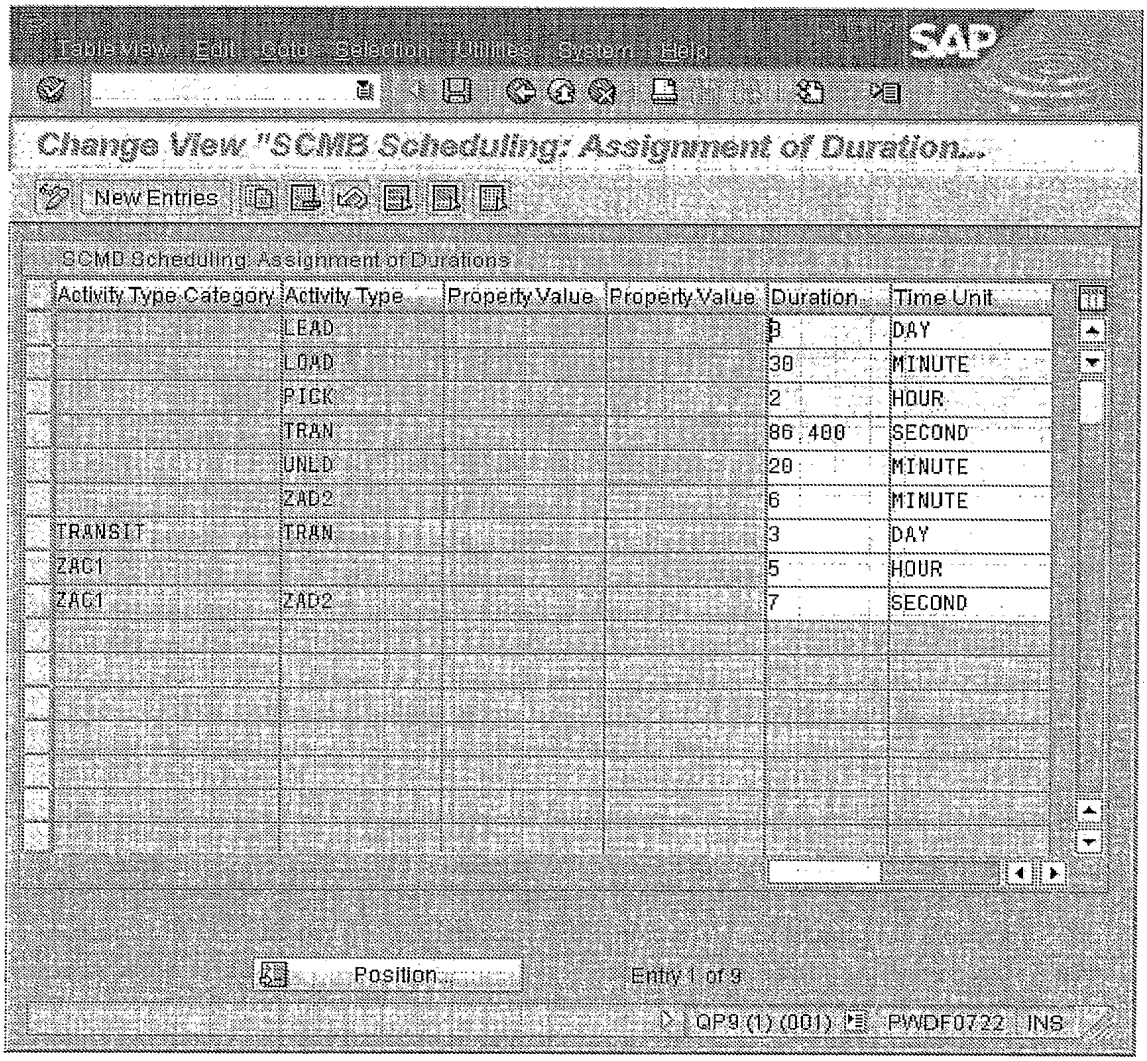
Table View Edit Goto Selection Utilities System Help
SAP
Change View "SCMB Scheduling: Assignment of Duration...
New Entries
SCMB Scheduling: Assignment of Durations
Activity Type Category | Activity Type | Property Value | Property Value | Duration | Time Unit
LEAD | 3 | DAY
LOAD | 30 | MINUTE
PICK | 2 | HOUR
TRAN | 86,400 | SECOND
UNLD | 20 | MINUTE
ZAD2 | 6 | MINUTE
TRANSIT | TRAN | 3 | DAY
ZAC1 | 5 | HOUR
ZAC1 | ZAD2 | 7 | SECOND
Position...
Entry 1 of 9
QP9 (1) (001) PWDF0722 INS

Fig. 10

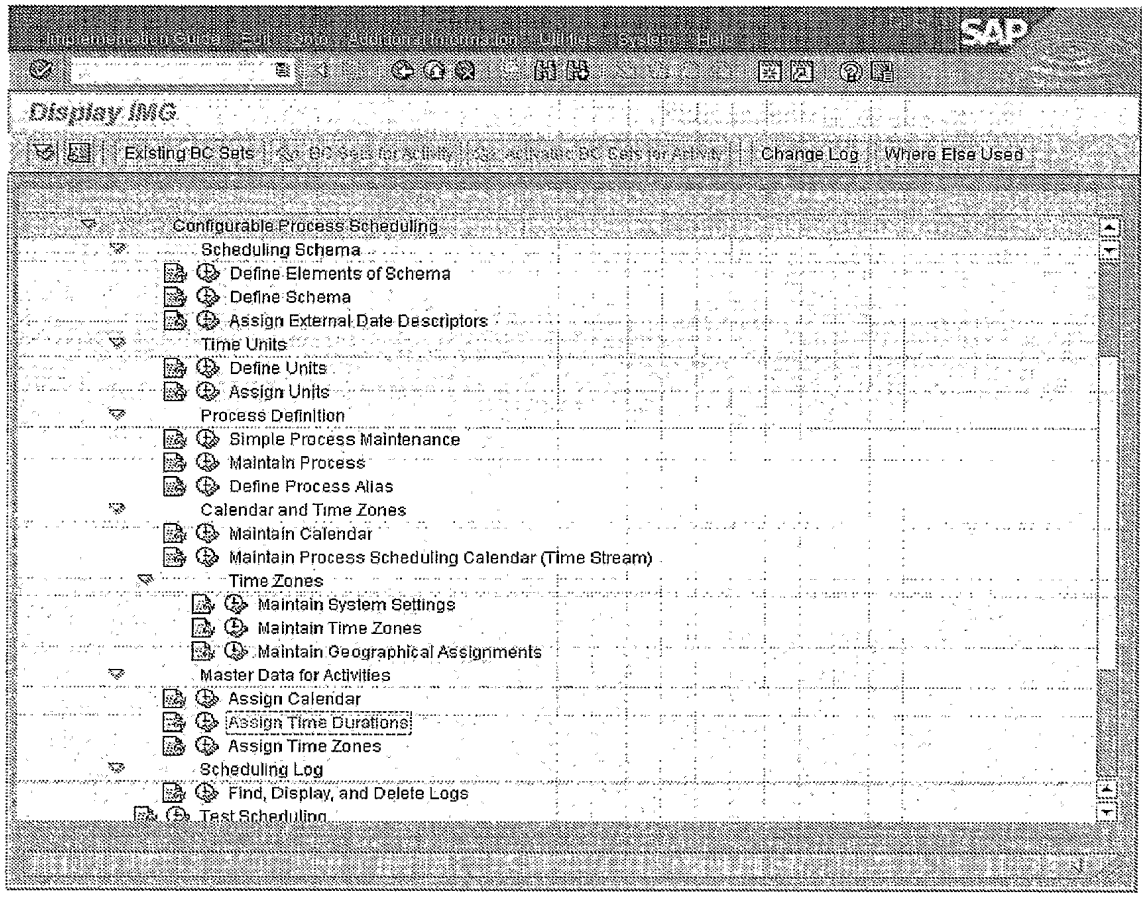
Display IMG
Existing BC Sets
Change Log
Where Else Used
Configurable Process Scheduling
Scheduling Schema
Define Elements of Schema
Define Schema
Assign External Date Descriptors
Time Units
Define Units
Assign Units
Process Definition
Simple Process Maintenance
Maintain Process
Define Process Alias
Calendar and Time Zones
Maintain Calendar
Maintain Process Scheduling Calendar (Time Stream)
Time Zones
Maintain System Settings
Maintain Time Zones
Maintain Geographical Assignments
Master Data for Activities
Assign Calendar
Assign Time Durations
Assign Time Zones
Scheduling Log
Find, Display, and Delete Logs
Test Scheduling

Fig. 11

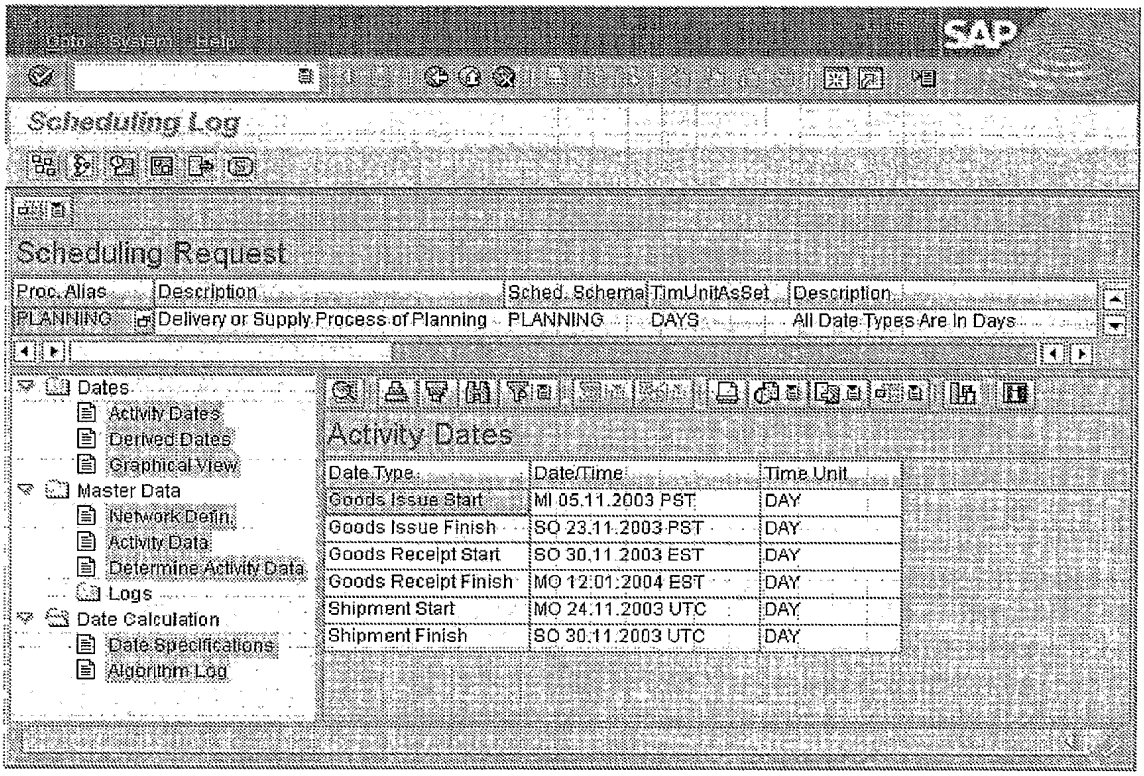
Scheduling Log
Scheduling Request
Proc. Alias
Description
Sched. Schema
TimUnitAsSet
Description
PLANNING
Delivery or Supply Process of Planning
PLANNING
DAYS
All Date Types Are In Days
Dates
Activity Dates
Derived Dates
Graphical View
Master Data
Network Defin.
Activity Data
Determine Activity Data
Logs
Date Calculation
Date Specifications
Algorithm Log
Activity Dates
Date Type
Date/Time
Time Unit
Goods Issue Start
MI 05.11.2003 PST
DAY
Goods Issue Finish
SO 23.11.2003 PST
DAY
Goods Receipt Start
SO 30.11.2003 EST
DAY
Goods Receipt Finish
MO 12.01.2004 EST
DAY
Shipment Start
MO 24.11.2003 UTC
DAY
Shipment Finish
SO 30.11.2003 UTC
DAY

Fig. 12A

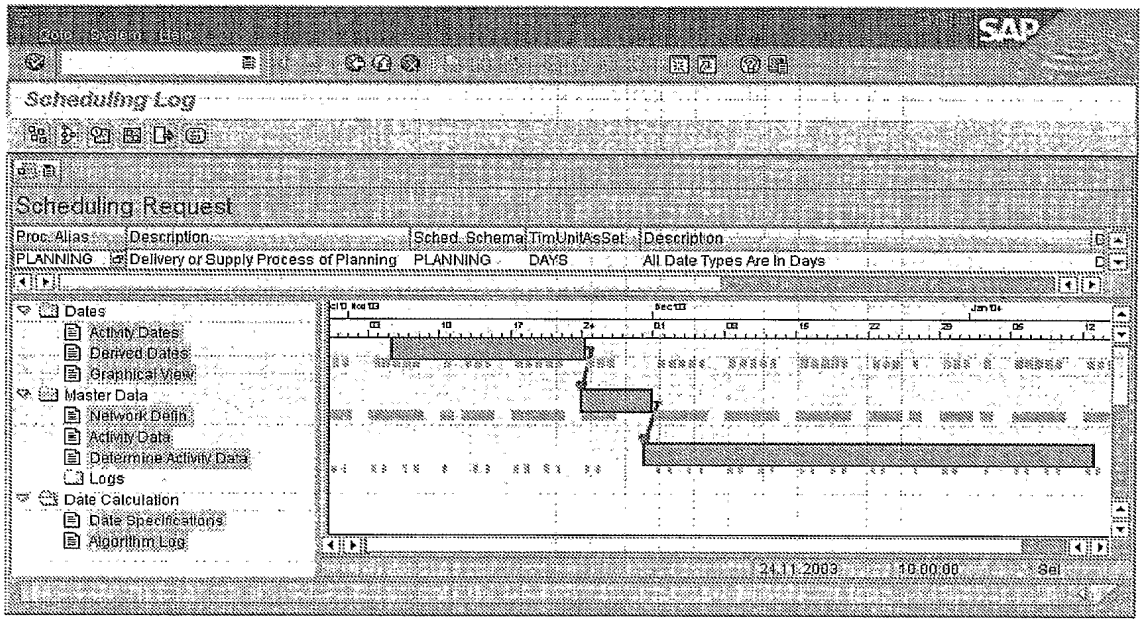
SAP
Scheduling Log
Scheduling Request
Proc. Alias
Description
Sched. Schema
TimUnitAsSet
Description
PLANNING
Delivery or Supply Process of Planning
PLANNING
DAYS
All Date Types Are In Days
Dates
Activity Dates
Derived Dates
Graphical View
Master Data
Network Defin.
Activity Data
Determine Activity Data
Logs
Date Calculation
Date Specifications
Algorithm Log
24.11.2003
10:00:00

Fig. 12B

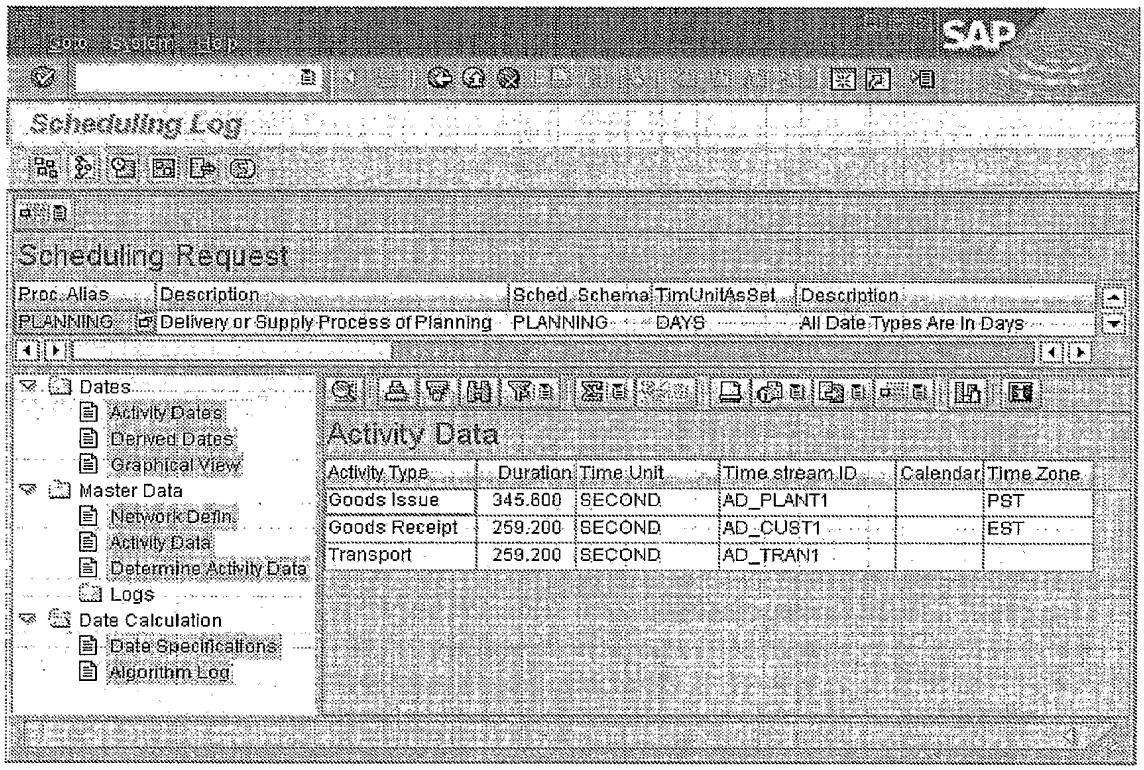
Scheduling Log
Scheduling Request
Proc Alias
Description
Sched Schema
TimUnitAsSet
Description
PLANNING
Delivery or Supply Process of Planning
PLANNING
DAYS
All Date Types Are In Days
Dates
Activity Dates
Derived Dates
Graphical View
Master Data
Network Defin.
Activity Data
Determine Activity Data
Logs
Date Calculation
Date Specifications
Algorithm Log
Activity Data
Activity Type
Duration
Time Unit
Time stream ID
Calendar
Time Zone
Goods Issue
345.600
SECOND
AD_PLANT1
PST
Goods Receipt
259.200
SECOND
AD_CUST1
EST
Transport
259.200
SECOND
AD_TRAN1

Fig. 12C

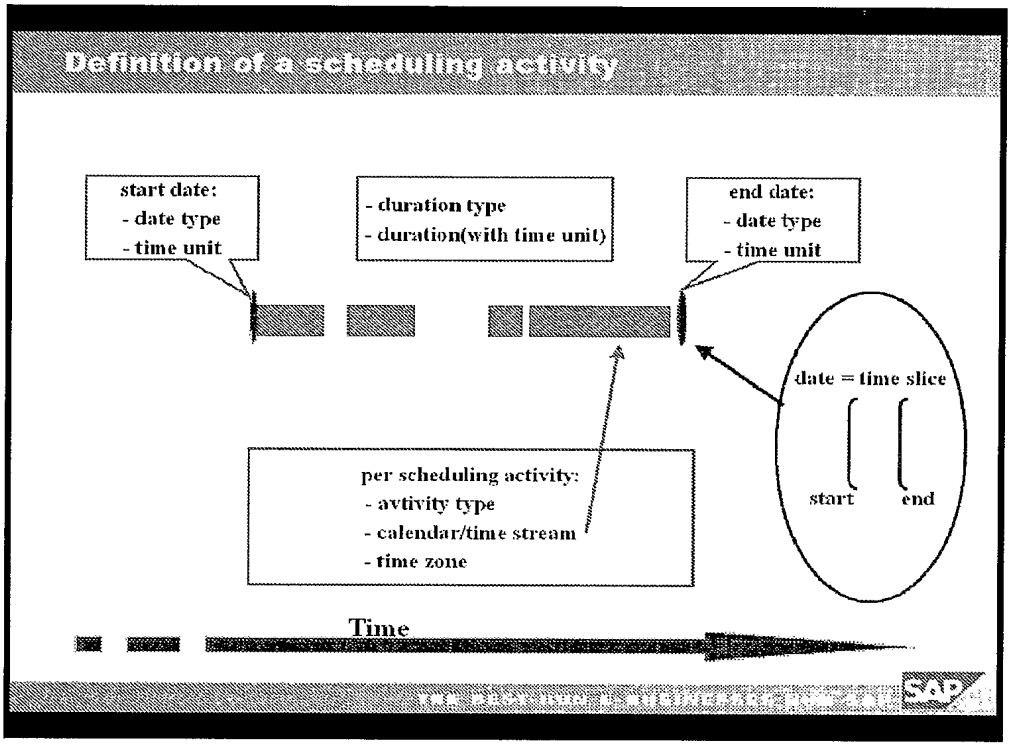
Definition of a scheduling activity
start date:
- date type
- time unit
- duration type
- duration(with time unit)
end date:
- date type
- time unit
date = time slice
start
end
per scheduling activity:
- avtivity type
- calendar/time stream
- time zone
Time

Fig. 13

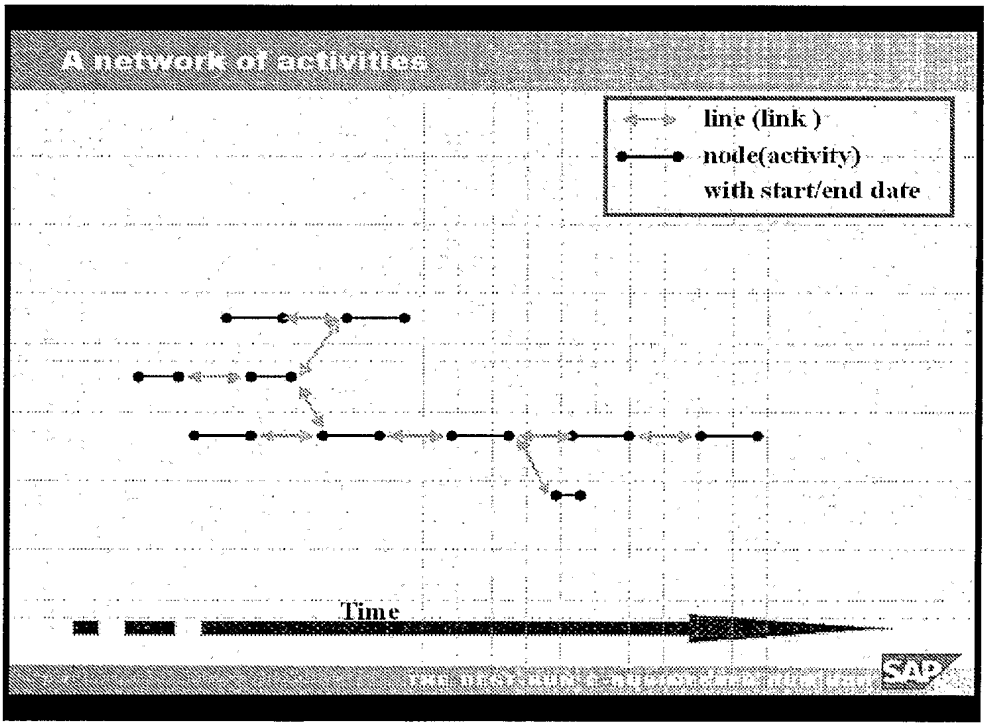
A network of activities
line (link)
node(activity)
with start/end date
Time
SAP

Fig. 14

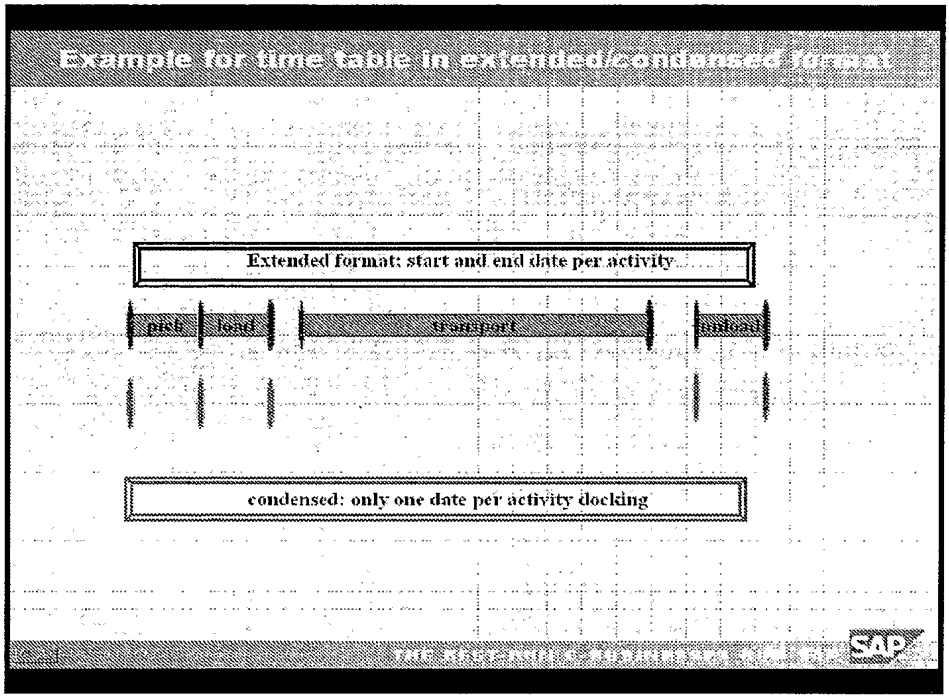
Example for time table in extended/condensed format
Extended format: start and end date per activity
pick
load
transport
unload
condensed: only one date per activity docking
SAP

Fig. 15

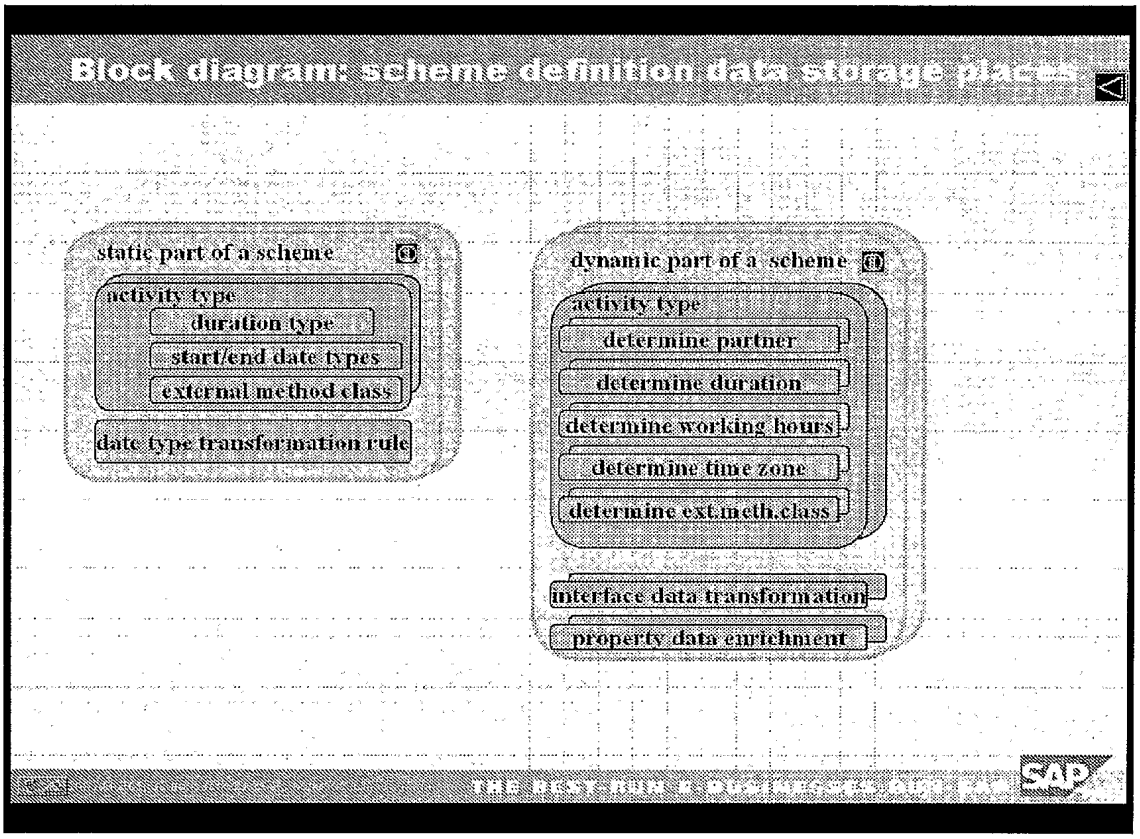
Block diagram: scheme definition data storage places
static part of a scheme
activity type
duration type
start/end date types
external method class
date type transformation rule
dynamic part of a scheme
activity type
determine partner
determine duration
determine working hours
determine time zone
determine ext.meth.class
interface data transformation
property data enrichment

Fig. 16

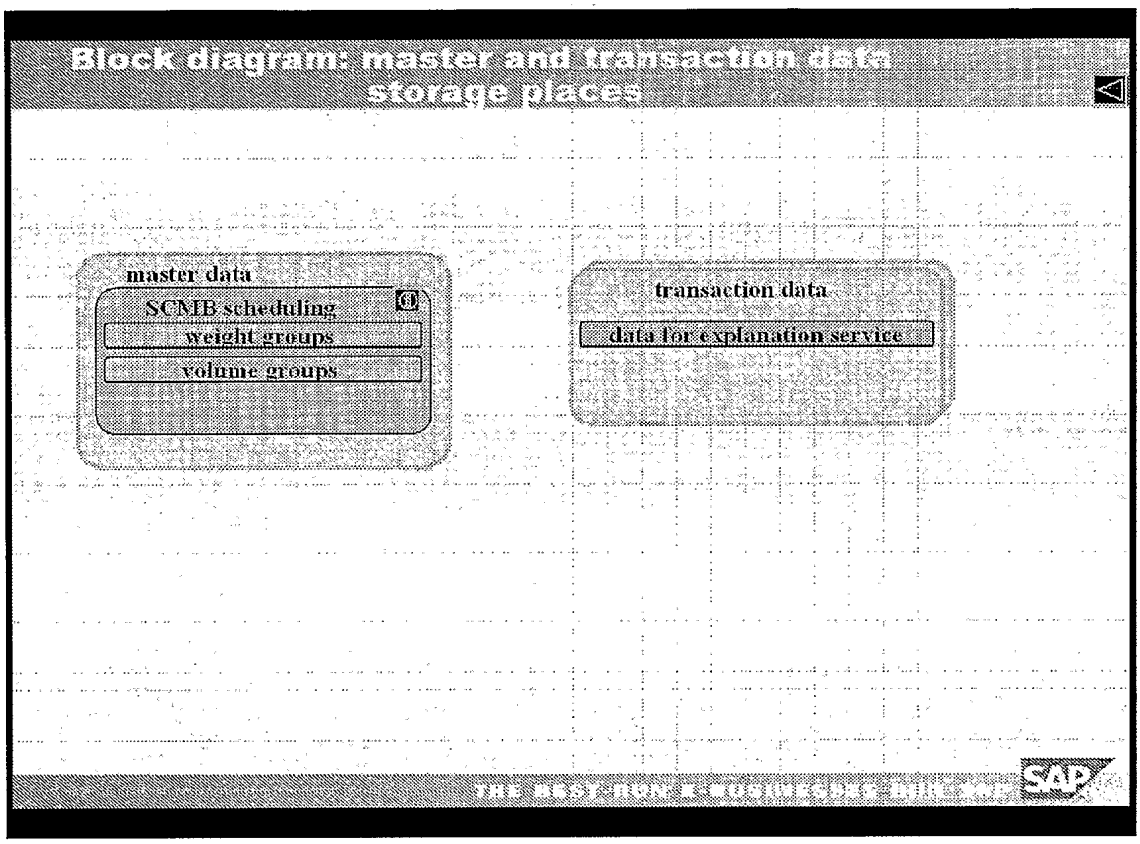
Block diagram: master and transaction data storage places
master data
SCMB scheduling
weight groups
volume groups
transaction data
data for explanation service

Fig. 17

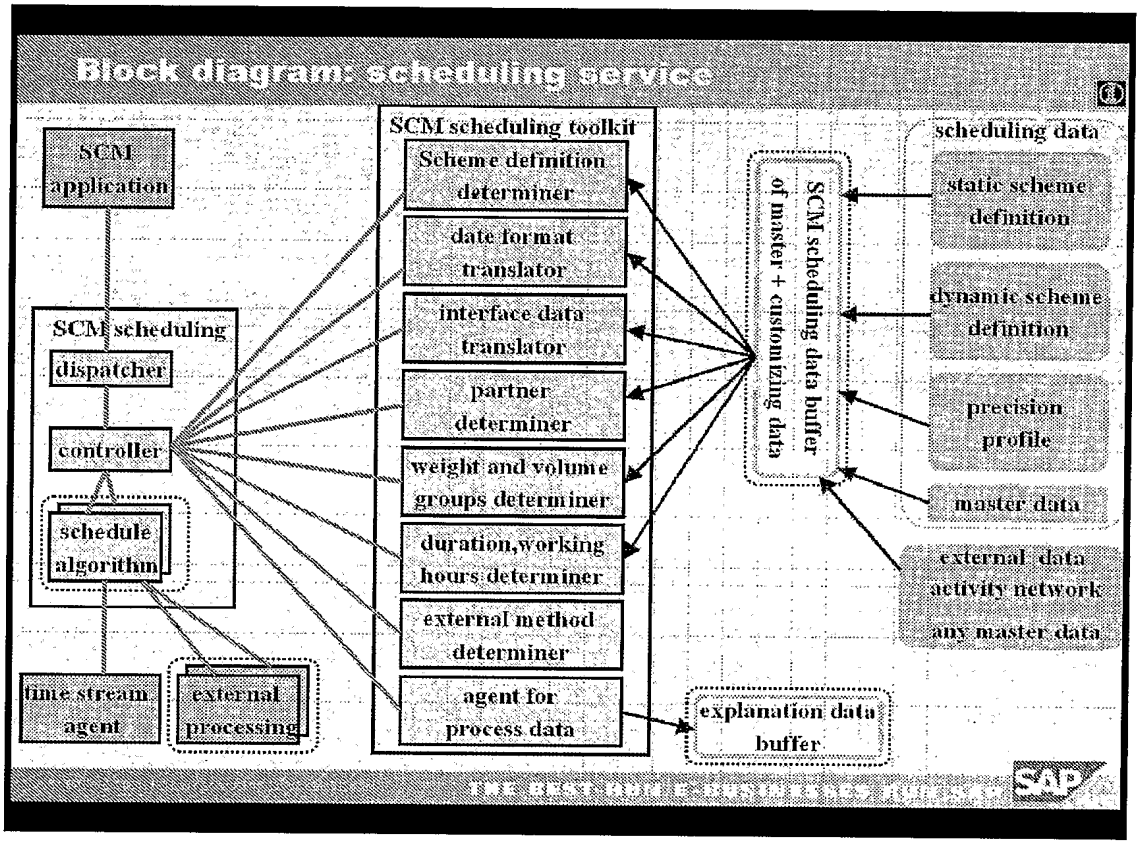
Block diagram: scheduling service
SCM application
SCM scheduling dispatcher
controller
schedule algorithm
time stream agent
external processing
SCM scheduling toolkit
Scheme definition determiner
date format translator
interface data translator
partner determiner
weight and volume groups determiner
duration,working hours determiner
external method determiner
agent for process data
SCM scheduling data buffer of master + customizing data
explanation data buffer
scheduling data
static scheme definition
dynamic scheme definition
precision profile
master data
external data
activity network
any master data

Fig. 18

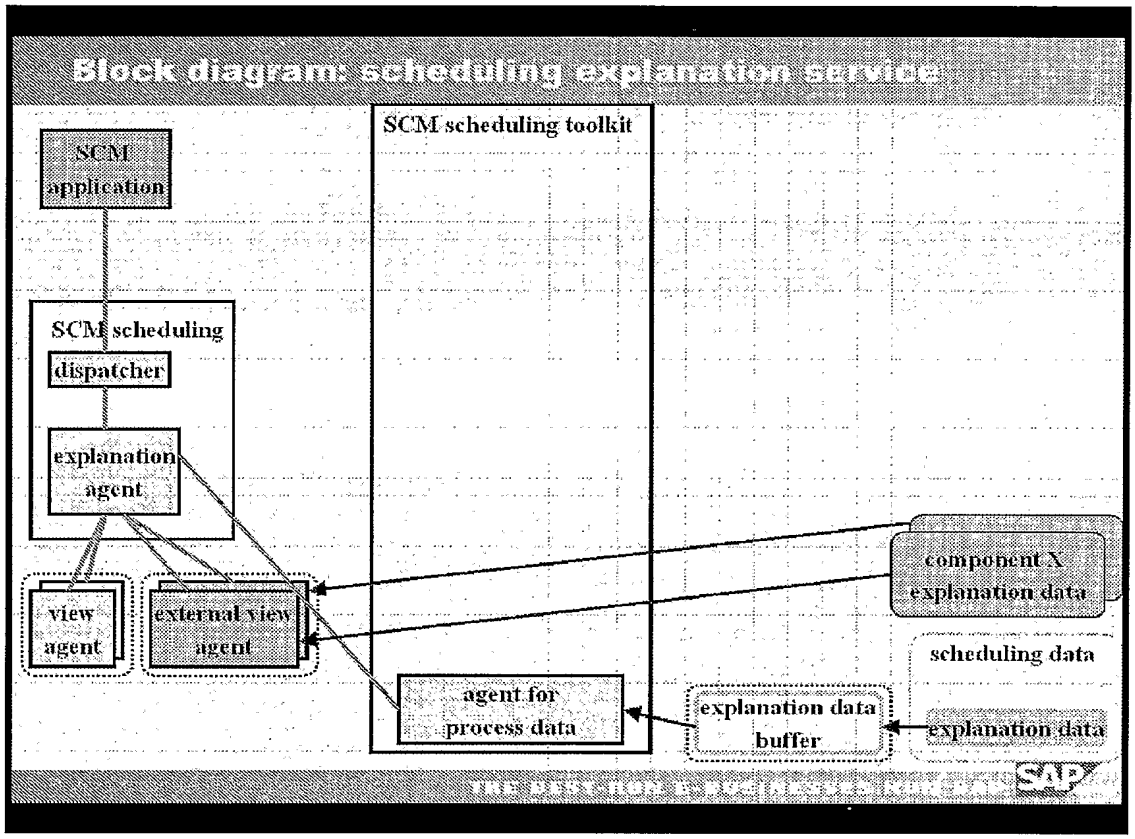
Block diagram: scheduling explanation service
SCM scheduling toolkit
SCM application
SCM scheduling
dispatcher
explanation agent
view agent
external view agent
component X explanation data
scheduling data
agent for process data
explanation data buffer
explanation data

Fig. 19

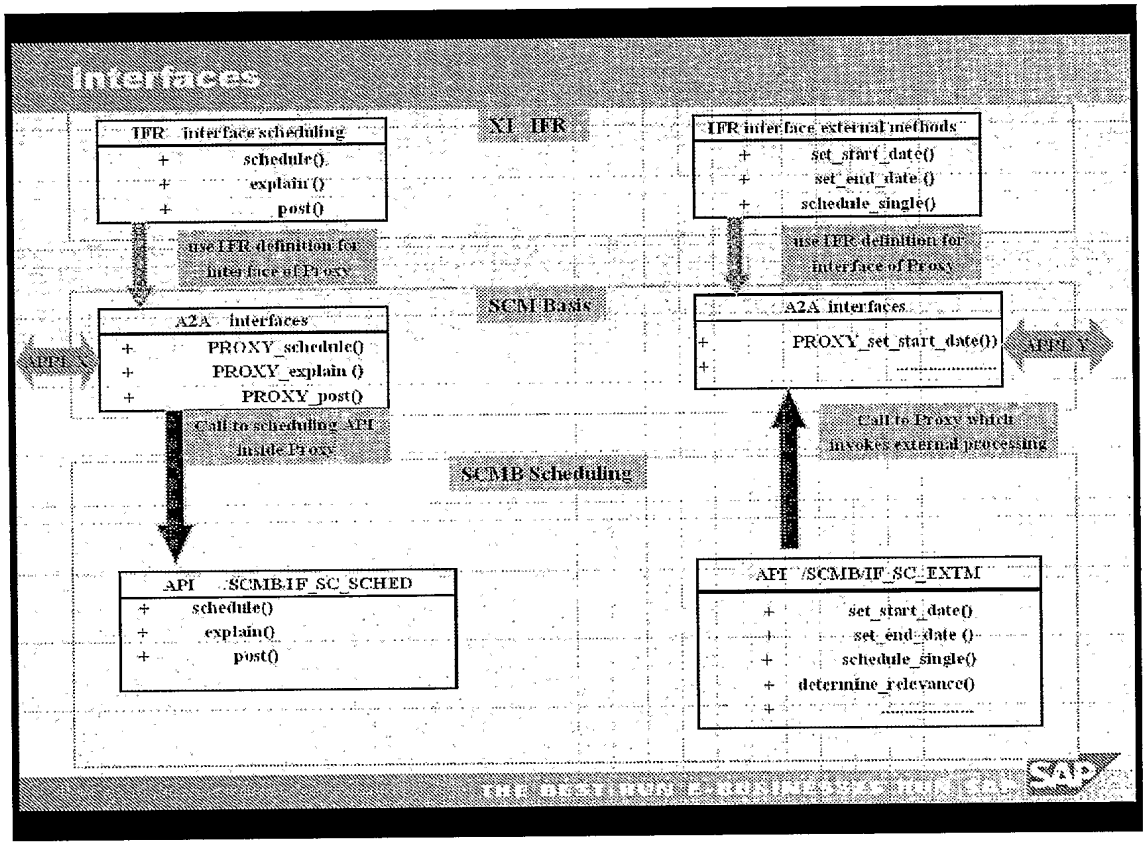
Interfaces
XI IFR
IFR interface scheduling
+ schedule()
+ explain()
+ post()
use IFR definition for interface of Proxy
IFR interface external methods
+ set_start_date()
+ set_end_date()
+ schedule_single()
use IFR definition for interface of Proxy
SCMI Basis
A2A interfaces
+ PROXY_schedule()
+ PROXY_explain()
+ PROXY_post()
A2A interfaces
+ PROXY_set_start_date()
+
API X
API Y
Call to scheduling API inside Proxy
Call to Proxy which invokes external processing
SCMB Scheduling
API /SCMB/IF_SC_SCHED
+ schedule()
+ explain()
+ post()
API /SCMB/IF_SC_EXTM
+ set_start_date()
+ set_end_date()
+ schedule_single()
+ determine_relevance()
+
SAP

Fig. 20

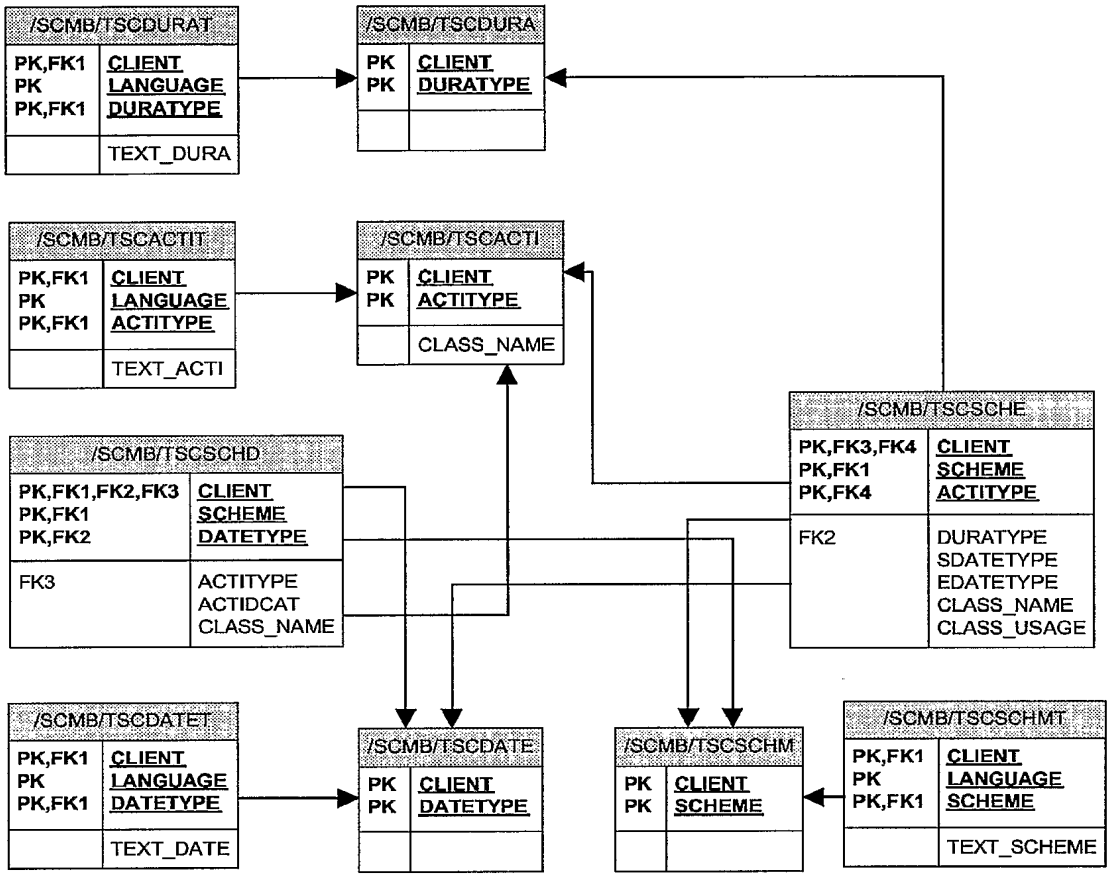
/SCMB/TSCDURAT
PK,FK1 CLIENT
PK LANGUAGE
PK,FK1 DURATYPE
TEXT_DURA
/SCMB/TSCDURA
PK CLIENT
PK DURATYPE
/SCMB/TSCACTIT
PK,FK1 CLIENT
PK LANGUAGE
PK,FK1 ACTITYPE
TEXT_ACTI
/SCMB/TSCACTI
PK CLIENT
PK ACTITYPE
CLASS_NAME
/SCMB/TSCSCHE
PK,FK3,FK4 CLIENT
PK,FK1 SCHEME
PK,FK4 ACTITYPE
FK2
DURATYPE
SDATETYPE
EDATETYPE
CLASS_NAME
CLASS_USAGE
/SCMB/TSCSCHD
PK,FK1,FK2,FK3 CLIENT
PK,FK1 SCHEME
PK,FK2 DATETYPE
FK3
ACTITYPE
ACTIDCAT
CLASS_NAME
/SCMB/TSCDATET
PK,FK1 CLIENT
PK LANGUAGE
PK,FK1 DATETYPE
TEXT_DATE
/SCMB/TSCDATE
PK CLIENT
PK DATETYPE
/SCMB/TSCSCHM
PK CLIENT
PK SCHEME
/SCMB/TSCSCHMT
PK,FK1 CLIENT
PK LANGUAGE
PK,FK1 SCHEME
TEXT_SCHEME

Fig. 21

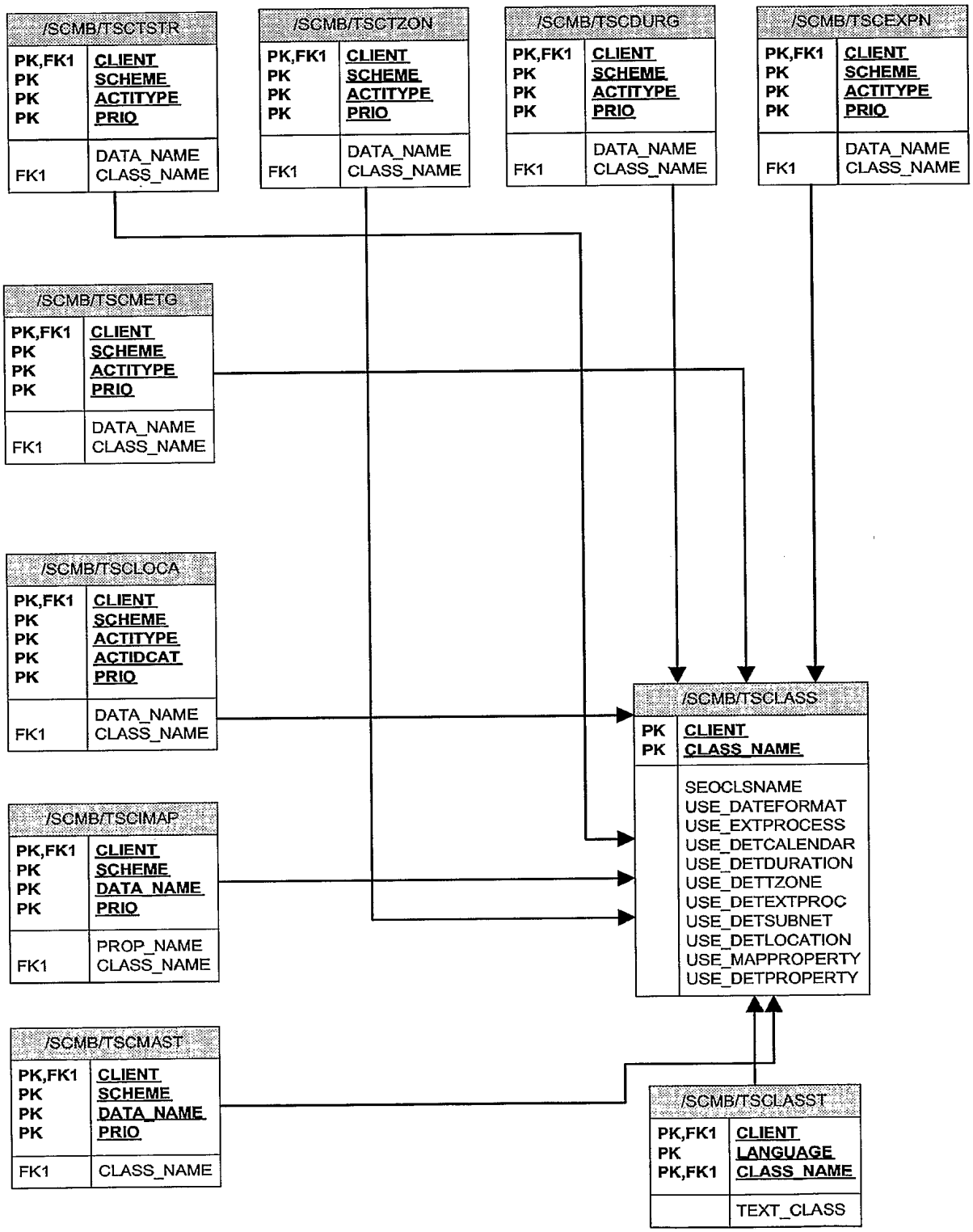
/SCMB/TSCTSTR
PK,FK1 CLIENT
PK SCHEME
PK ACTITYPE
PK PRIO
DATA_NAME
FK1 CLASS_NAME
/SCMB/TSCTZON
PK,FK1 CLIENT
PK SCHEME
PK ACTITYPE
PK PRIO
DATA_NAME
FK1 CLASS_NAME
/SCMB/TSCDURG
PK,FK1 CLIENT
PK SCHEME
PK ACTITYPE
PK PRIO
DATA_NAME
FK1 CLASS_NAME
/SCMB/TSCEXPN
PK,FK1 CLIENT
PK SCHEME
PK ACTITYPE
PK PRIO
DATA_NAME
FK1 CLASS_NAME
/SCMB/TSCMETG
PK,FK1 CLIENT
PK SCHEME
PK ACTITYPE
PK PRIO
DATA_NAME
FK1 CLASS_NAME
/SCMB/TSCLOCA
PK,FK1 CLIENT
PK SCHEME
PK ACTITYPE
PK ACTIDCAT
PK PRIO
DATA_NAME
FK1 CLASS_NAME
/SCMB/TSCLASS
PK CLIENT
PK CLASS_NAME
SEOCLSNAME
USE_DATEFORMAT
USE_EXTPROCESS
USE_DETCALENDAR
USE_DETDURATION
USE_DETTZONE
USE_DETEXTPROC
USE_DETSUBNET
USE_DETLOCATION
USE_MAPPROPERTY
USE_DETPROPERTY
/SCMB/TSCIMAP
PK,FK1 CLIENT
PK SCHEME
PK DATA_NAME
PK PRIO
PROP_NAME
FK1 CLASS_NAME
/SCMB/TSCMAST
PK,FK1 CLIENT
PK SCHEME
PK DATA_NAME
PK PRIO
FK1 CLASS_NAME
/SCMB/TSCLASST
PK,FK1 CLIENT
PK LANGUAGE
PK,FK1 CLASS_NAME
TEXT_CLASS

Fig. 22

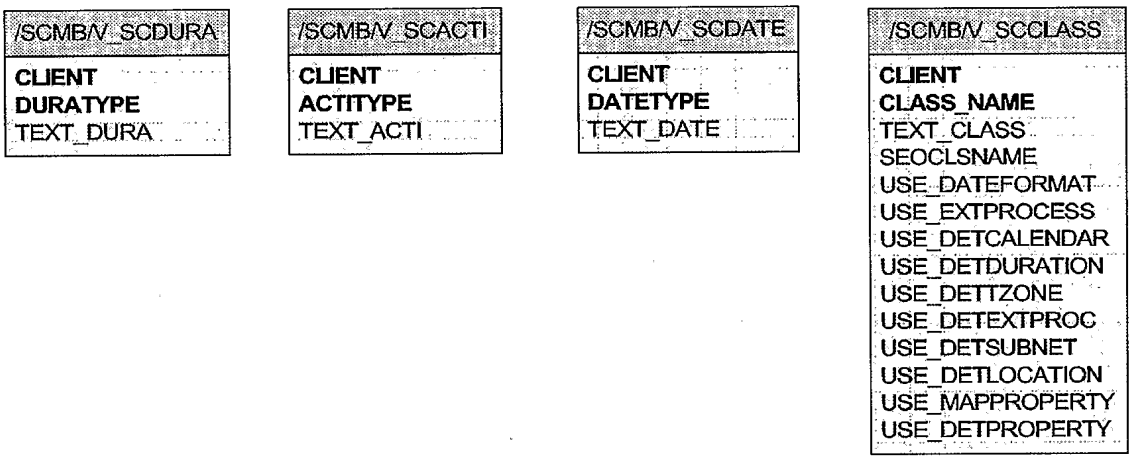
/SCMB/V_SCDURA
CLIENT
DURATYPE
TEXT_DURA
/SCMB/V_SCACTI
CLIENT
ACTITYPE
TEXT_ACTI
/SCMB/V_SCDATE
CLIENT
DATETYPE
TEXT_DATE
/SCMB/V_SCCLASS
CLIENT
CLASS_NAME
TEXT_CLASS
SEOCLSNAME
USE_DATEFORMAT
USE_EXTPROCESS
USE_DETCALENDAR
USE_DETDURATION
USE_DETTZONE
USE_DETEXTPROC
USE_DETSUBNET
USE_DETLOCATION
USE_MAPPROPERTY
USE_DETPROPERTY

Fig. 23

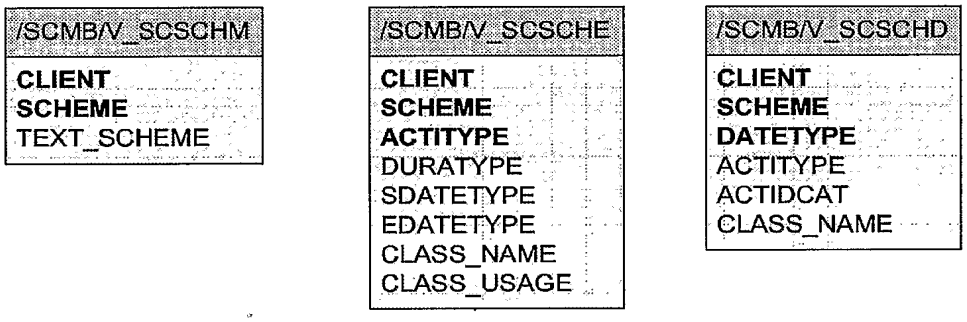
/SCMB/V_SCSCHM
CLIENT
SCHEME
TEXT_SCHEME
/SCMB/V_SCSCHE
CLIENT
SCHEME
ACTITYPE
DURATYPE
SDATETYPE
EDATETYPE
CLASS_NAME
CLASS_USAGE
/SCMB/V_SCSCHD
CLIENT
SCHEME
DATETYPE
ACTITYPE
ACTIDCAT
CLASS_NAME

Fig. 24

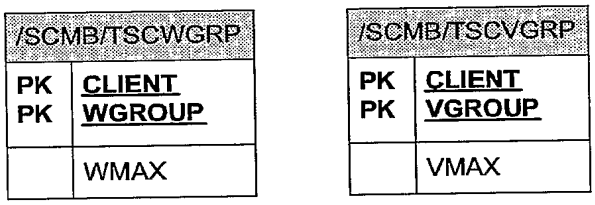
/SCMB/TSCWGRP
PK CLIENT
PK WGROUP
WMAX
/SCMB/TSCVGRP
PK CLIENT
PK VGROUP
VMAX

Fig. 25

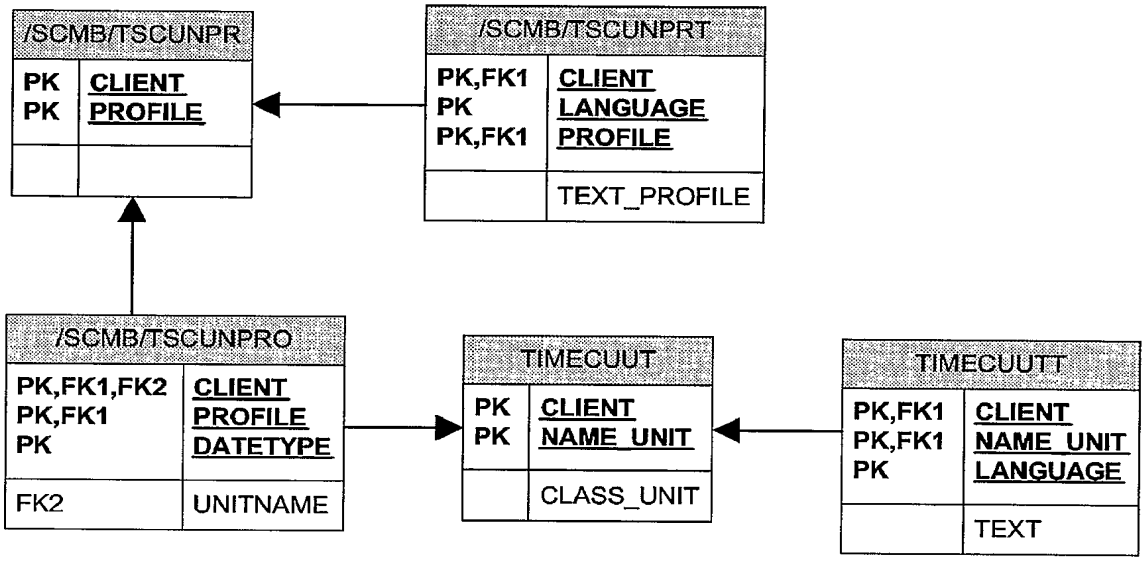
/SCMB/TSCUNPR
PK CLIENT
PK PROFILE
/SCMB/TSCUNPRT
PK,FK1 CLIENT
PK LANGUAGE
PK,FK1 PROFILE
TEXT_PROFILE
/SCMB/TSCUNPRO
PK,FK1,FK2 CLIENT
PK,FK1 PROFILE
PK DATETYPE
FK2 UNITNAME
TIMECUUT
PK CLIENT
PK NAME_UNIT
CLASS_UNIT
TIMECUUTT
PK,FK1 CLIENT
PK,FK1 NAME_UNIT
PK LANGUAGE
TEXT

Fig. 26

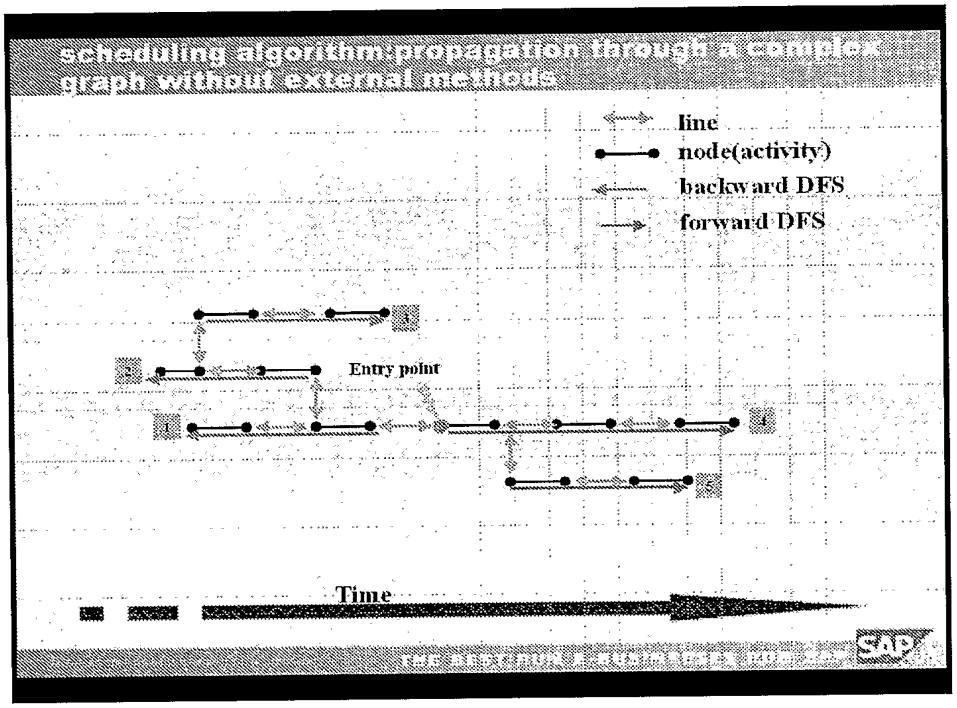
scheduling algorithm: propagation through a complex graph without external methods
line
node(activity)
backward DFS
forward DFS
Entry point
Time

Fig. 27

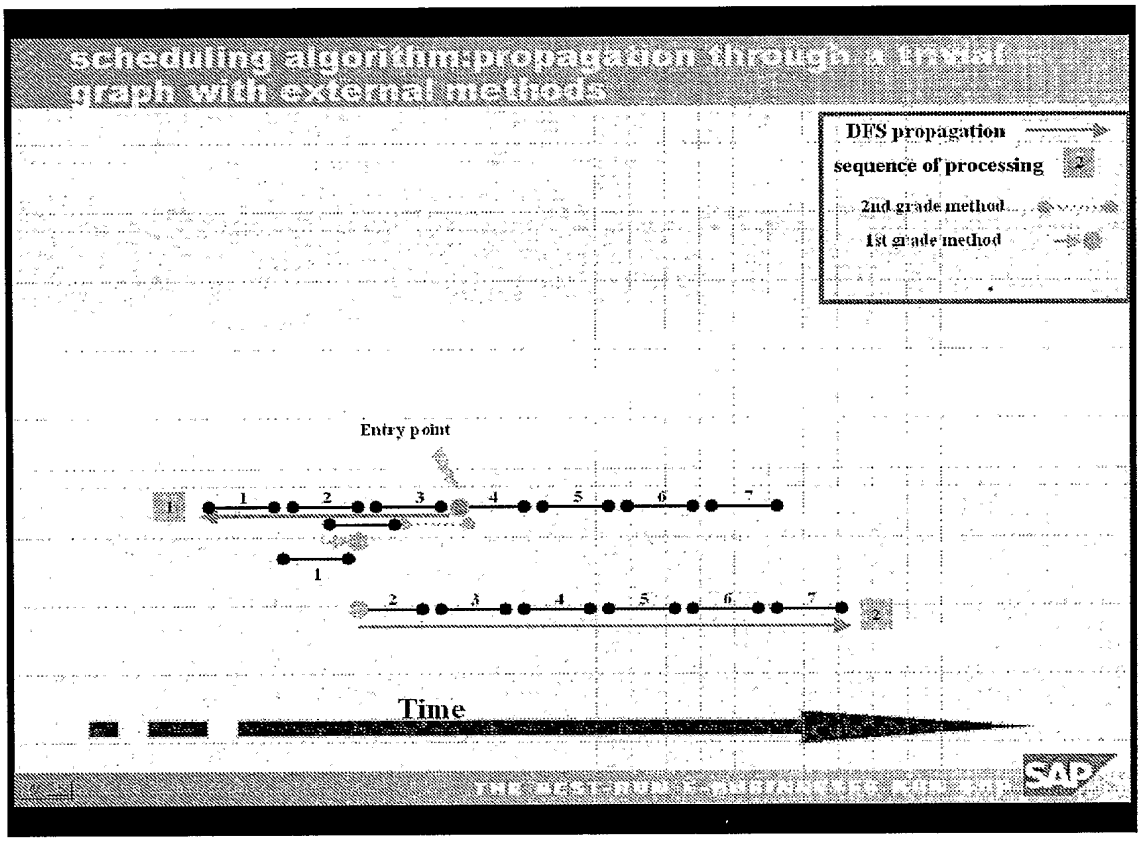
scheduling algorithm:propagation through a forward graph with external methods
DFS propagation
sequence of processing
2nd grade method
1st grade method
Entry point
1
2
3
4
5
6
7
Time
SAP

Fig. 28

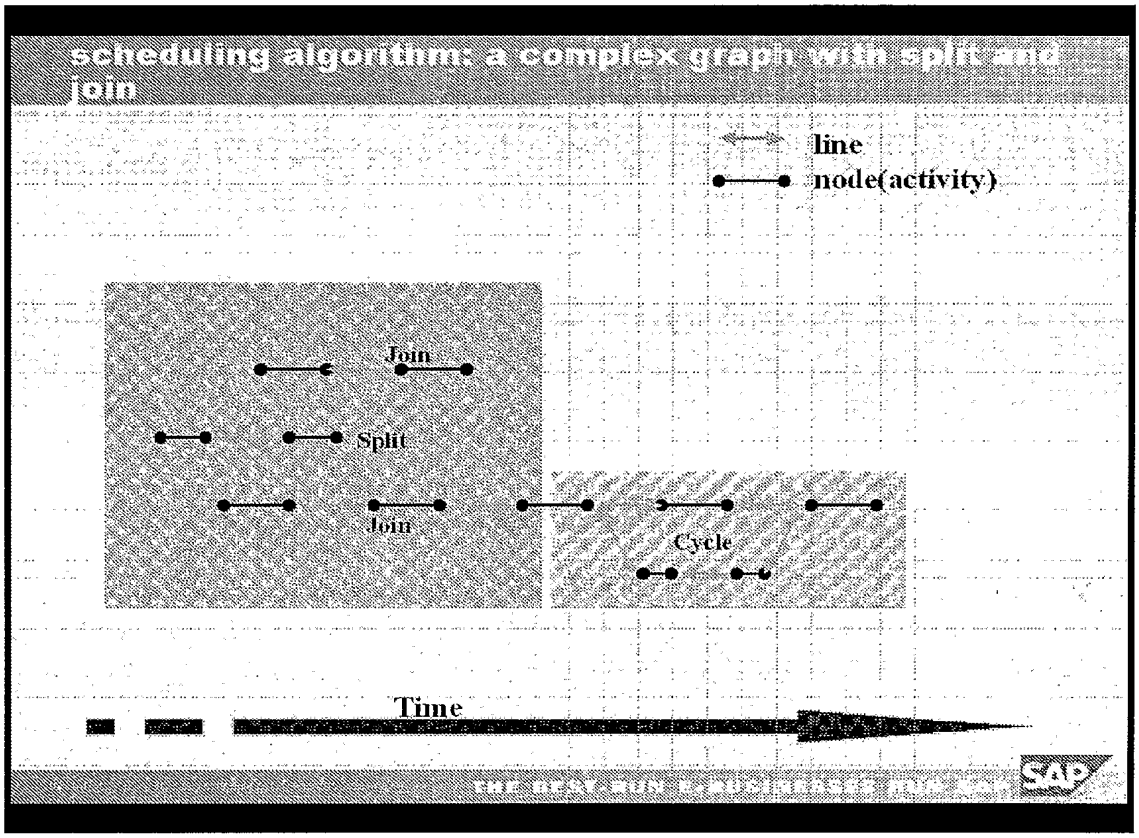
scheduling algorithms: a complex graph with split and join
line
node(activity)
Join
Split
Join
Cycle
Time

Fig. 29

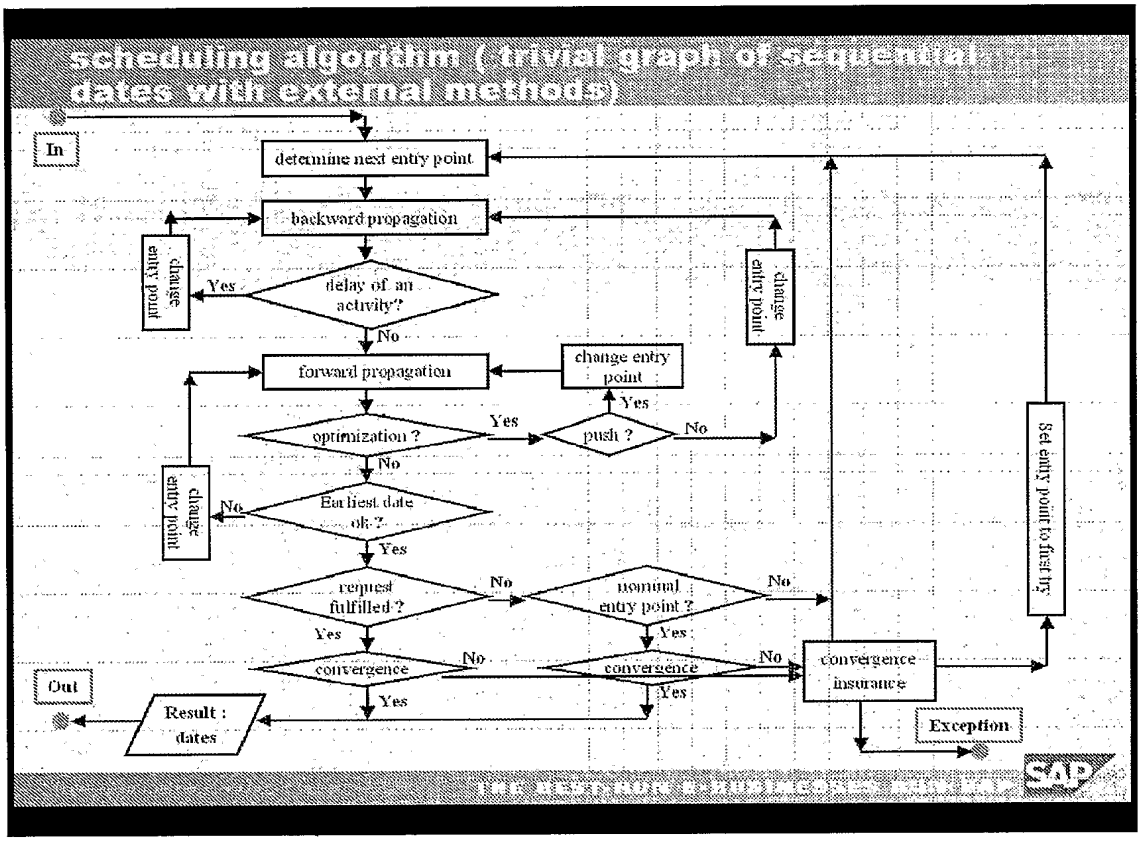
scheduling algorithm (trivial graph of sequential dates with external methods)
In
determine next entry point
backward propagation
change entry point
delay of an activity?
Yes
No
forward propagation
change entry point
optimization ?
Yes
push ?
Yes
No
No
change entry point
Earliest date ok ?
No
Yes
request fulfilled ?
No
nominal entry point ?
No
Yes
Yes
convergence
No
convergence
No
Yes
Yes
convergence insurance
Set entry point to first try
Exception
Out
Result : dates

Fig. 30

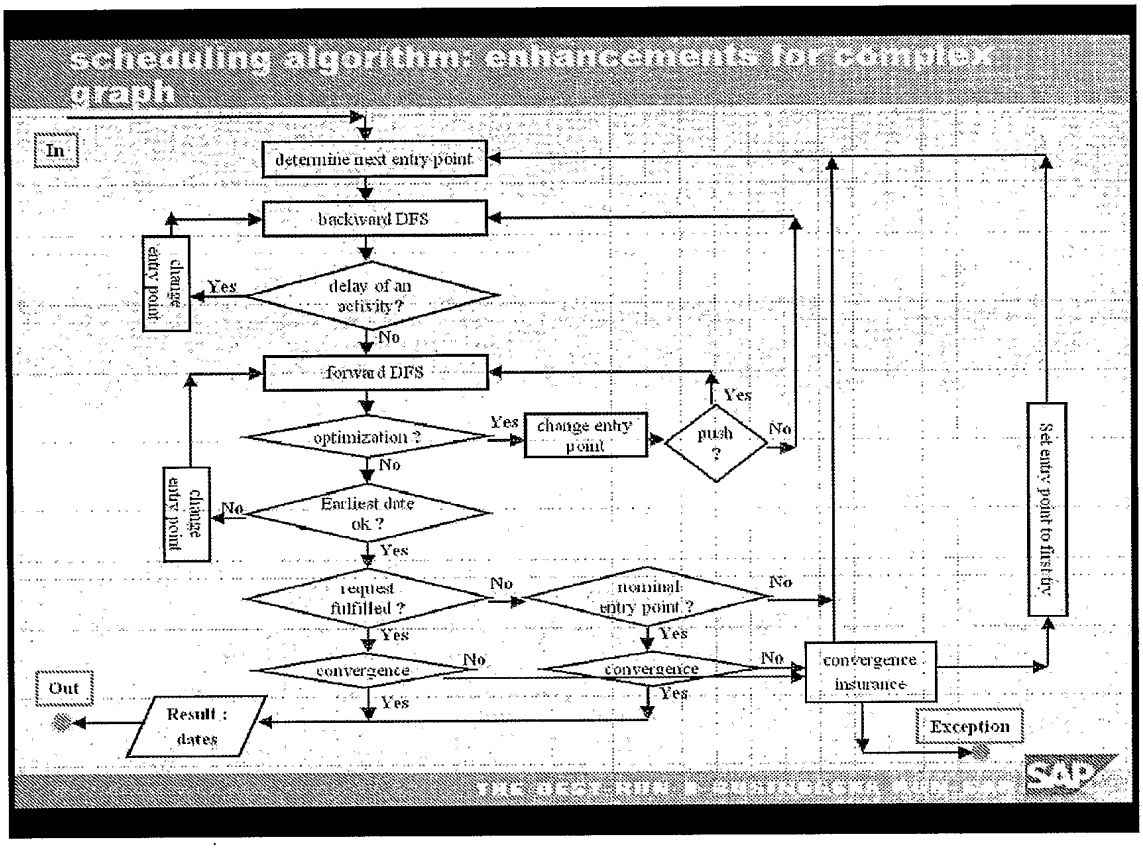
scheduling algorithm: enhancements for complex graph
In
determine next entry point
backward DFS
change entry point
Yes
delay of an activity ?
No
forward DFS
optimization ?
Yes
change entry point
push ?
Yes
No
change entry point
No
Earliest date ok ?
Yes
request fulfilled ?
No
nominal entry point ?
No
Yes
Yes
convergence
No
convergence
No
convergence insurance
Set entry point to first activ
Out
Result : dates
Yes
Yes
Exception

Fig. 31

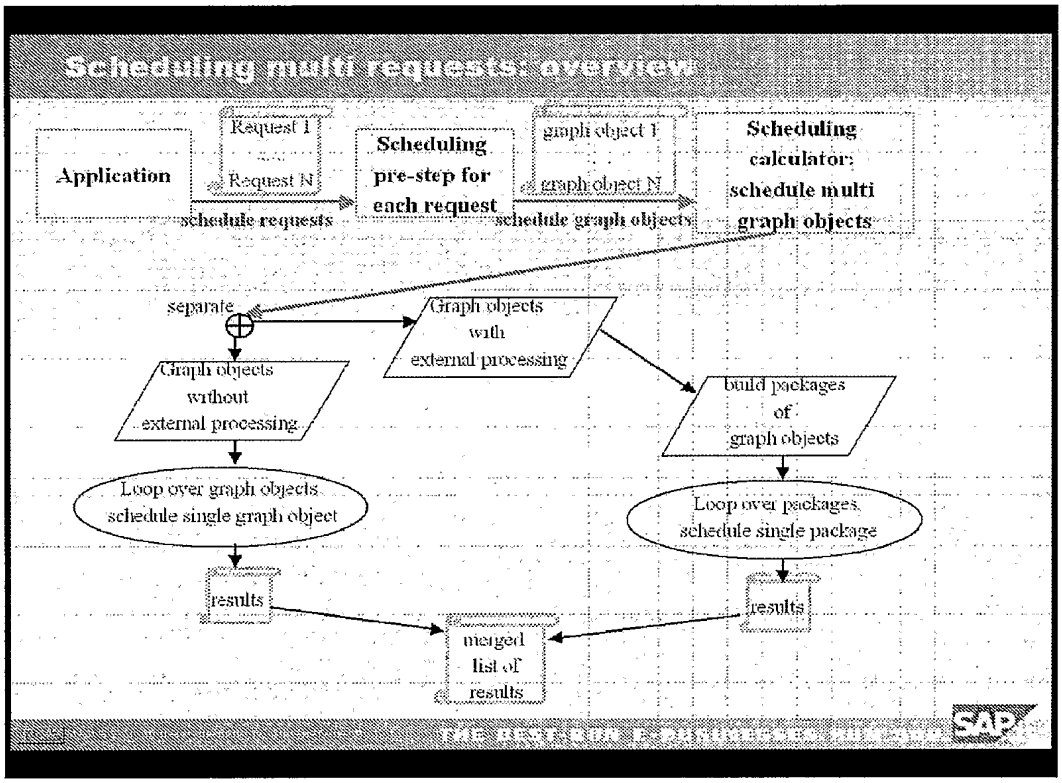
Scheduling multi requests: overview
Application
Request 1
Request N
schedule requests
Scheduling pre-step for each request
graph object 1
graph object N
schedule graph objects
Scheduling calculator: schedule multi graph objects
separate
Graph objects without external processing
Graph objects with external processing
build packages of graph objects
Loop over graph objects schedule single graph object
Loop over packages schedule single package
results
results
merged list of results

Fig. 32

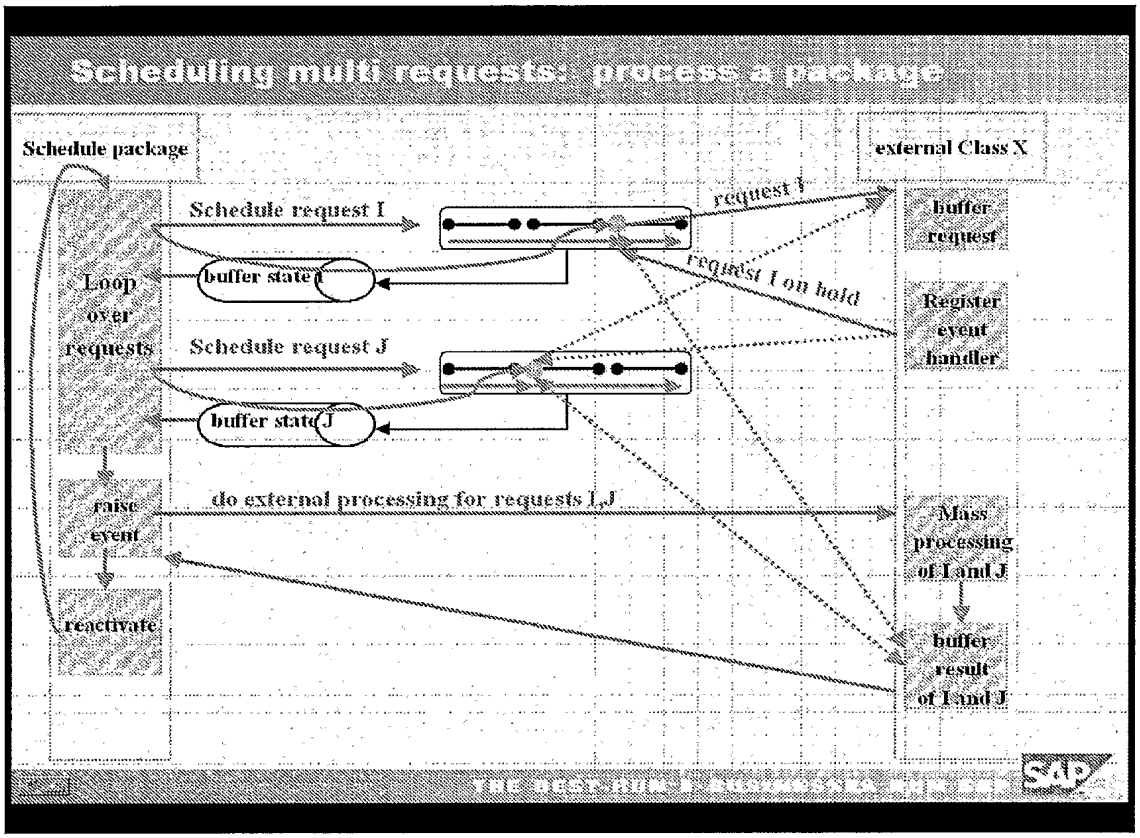
Scheduling multi requests: process a package
Schedule package
external Class X
Schedule request I
request I
buffer request
buffer state I
request I on hold
Loop over requests
Register event handler
Schedule request J
buffer state J
raise event
do external processing for requests I,J
Mass processing of I and J
reactivate
buffer result of I and J

Fig. 33

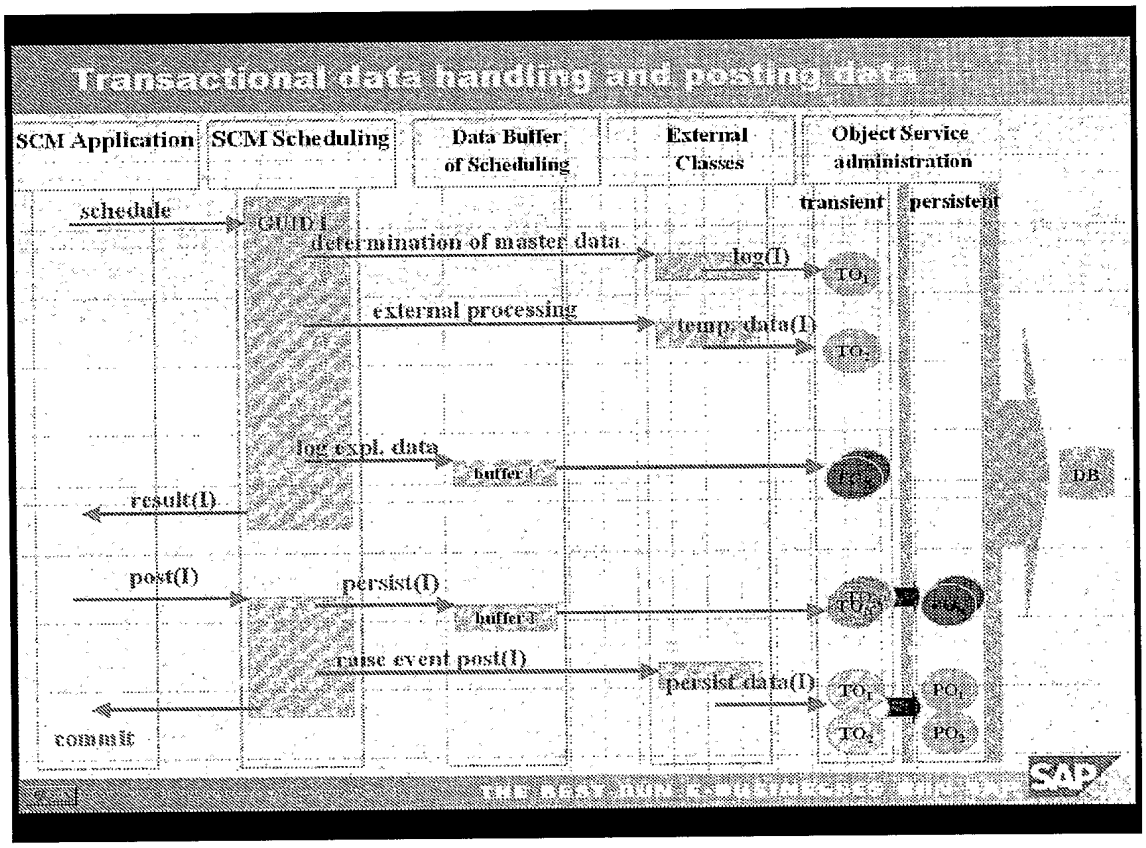
Transactional data handling and posting data
SCM Application
SCM Scheduling
Data Buffer of Scheduling
External Classes
Object Service administration
transient
persistent
schedule
GUID 1
determination of master data
log(I)
external processing
temp. data(I)
log expl. data
buffer 1
result(I)
DB
post(I)
persist(I)
buffer 2
raise event post(I)
persist data(I)
commit

Fig. 34